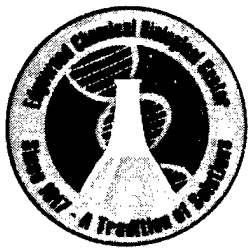

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ECBC-TR-314

SUPERCRITICAL CARBON DIOXIDE INTERACTION WITH POLYMERIC MATERIALS: DESORPTION DIFFUSION COEFFICIENT MEASUREMENTS

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14. ABSTRACT

Chemical-polymer compatibility is an important criterion in the development of solvent-based extraction and cleaning systems for removal of toxic contaminants from polymeric surfaces. The potential degradation of polymer properties and performance is especially critical for sensitive equipment cleaning, decontamination, and extraction. The candidate cleaning fluids for sensitive equipment include fluorocarbons and supercritical fluids. An overall material evaluation strategy has been developed for evaluating the degradation of polymer properties by exposure to supercritical fluids. The initial evaluation involves the measurement of the sorption and desorption diffusion coefficients in a spectrum of polymer compositions. The objective was to characterize the complete desorption process by the continuous measurement of the entire diffusion process. Another purpose of diffusion coefficient measurements was to provide an estimate of the time required for each material to completely desorb all of the carbon dioxide cleaning fluid and return the material to the original unplasticized condition. These measurements and calculations provided the high data density required to calculate a low concentration Fick's Law diffusion coefficient and equation for the extrapolations. The composition spectrum selected contains hydrogen bond donor, hydrogen bond acceptor, dipolar, and non-polar polymer structures. Over 20 thermoplastics and elastomers were studied with supercritical carbon dioxide.

15. SUBJECT TERMS

Supercritical carbon dioxide	Fick's Law diffusion	Chemical agent	Extraction
Supercritical CO2	Contaminant extraction	Diffusion coefficient	Decontamination
Thermogravimetric analysis	Sensitive equipment	Diffusion	

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PREFACE

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SUPERCRITICAL CARBON DIOXIDE INTERACTION WITH POLYMERIC MATERIALS: DESORPTION DIFFUSION COEFFICIENT MEASUREMENTS

1. INTRODUCTION

Chemical-material compatibility is a critical criterion in development of a decontamination system. The degradation of material properties and performance is especially important for sensitive equipment cleaning and decontamination. Sensitive equipment includes electronics, optics, and other high-value and unique equipment. The candidate cleaning fluids for sensitive equipment include supercritical carbon dioxide and fluorocarbons.

The overall material evaluation methodology for compatibility with decontaminants is under development.[1-3] The selection of representative materials for compatibility testing is underway based on several parallel approaches. These include a top-down, materiel-to-material analysis that identifies surface materials in a spectrum of high-cost equipment. Several material science based approaches were also applied to identify a spectrum of material physical states, molecular structures, and hydrogen bond and polarity classes.[4]

The initial evaluation in any chemical-material evaluation test scheme usually involves measurement of sorption or solubility of the candidate cleaning fluid in a spectrum of relevant material compositions. This methodology can also be applied to the desorption measurements of the contaminants by a thermal decontamination process or by solvent system based decontaminants, such as Decon Green. The desorption diffusion methodology developed is also applicable to investigations on the environmental fate of hazardous chemicals on material surfaces in wind tunnel experiments. The supercritical carbon dioxide processing conditions and material sorption experimentation are being reported separately. The experimentation reported herein concentrates on the desorption diffusion kinetic process for supercritical carbon dioxide from polymeric materials.[5]

The purpose is to characterize the complete desorption diffusion process by continuous measurement of the entire diffusion curve, with the exception of a few minute time increment at the start of the experiment and a few percent of the final weight-loss. The next purpose was to use the continuous desorption curve to provide an accurate extrapolation of the zero-time sorption value immediately after supercritical carbon dioxide decompression. This extrapolation from the high concentration region of the desorption curve allowed calculation of a corrected sorption value for each material that provided an accurate ranking of material solubility relative to the uncorrected values. The characterization of the plateau to equilibrium desorption allowed the measurement of extractables and, therefore, the correction of the sorption value for this fraction extracted. Another purpose of diffusion coefficient measurements was to provide an estimate of the time required for each material to completely desorb all of the carbon dioxide cleaning fluid and return the material to the original unplasticized condition. These measurements and calculations provide an estimated 'time before reuse' after the decontamination process. The continuous measurement of desorption provided the high data density required to calculate a low concentration Fick's Law diffusion coefficient and equation

for the extrapolation to initial material sample weight before exposure. The experimental strategy includes mechanical, optical, thermal, and electrical property characterization to measure the influence of the sorbed decontaminant. In this initial screening stage, indentation hardness measurements of surface mechanical properties were completed.

2. EXPERIMENTATION

2.1 Extraction Instrumentation.

The extraction instruments and cells employed to expose the materials to supercritical carbon dioxide are listed in Table 1. The instrument cell nomenclature, dimensions, and volume are provided in the first four columns. The dimensions refer to the useable space for material specimens. The fifth column lists the type of test performed with specimens exposed in the various cell sizes. In general, the diffusion specimens were relatively small; therefore, the smaller cell sizes were employed.

Table 1. Supercritical Fluid Cell Dimensions and Volume for Extraction Equipment of Several Different Capacities

Cell	Equipment	Dimensions (cm): diameter x length	Volume (mL)	Test Specimen	Materials: Cell with Specimen Packing
1	Hewlett Packard Cartridge (07680-61370) for HP7680T	1 x 7	5.5	Desorption	Stainless steel with Whatman GF/A 90mm glass microfibre filter
2	Applied Separations Cell for Applied Separations SCF Extractor	1.3 x 15	24	Desorption, Flex, DMA	Stainless steel with Applied Separations Polypropylene Wool
3	Thar Designs Cell for Applied Separations SCF Extractor	3 x 23	140	Tensile, thermoplastics	Stainless steel
4	Thar Designs Cell for Applied Separations SCF Extractor	5.3 x 15	350	Tensile, elastomers	Stainless steel
5	Vessel for CF Technologies Extractor	17 x 43 basket	6500	Tensile, others	Stainless steel

2.2 Desorption Instrumentation.

A Mettler Model AT261 (Toledo, OH) macrobalance balance was used for correlation of specimen weights with the microbalance and provided reproducibility of 0.015 mg and readability of 0.01 mg. A New Age Industries Model Exacta EX200/300 Series instrument (New Age Industries Inc., Willow Grove, PA) was used for the indentation hardness measurements.

The thermogravimetric instruments employed to measure the continuous desorption of sorbed supercritical carbon dioxide were a TA Model TGA 2950 and Model TGA 951 (TA Instruments Inc., New Castle, DE). The final values reported were all measured with a combination of the Model TGA 2950 and control software Version 8.10B (2.3A).

Custom specimen holders were required for the unique research measurements and were constructed to clamp the ca. 1-cm diameter disk shaped specimens, allowing free surface diffusion on all sides. The 0.62-0.64 mm diameter nichrome wire was formed to a shape that matched the TGA Model 2950 hang down wire hook, cleared the furnace sides, and avoided buoyancy fluctuations.

The experimental conditions employed in the desorption measurement process are recorded in Table 2. The microbalance performance depends on the range and capacity used in the experiment, and these are listed in the first three rows of the table. The resolution and accuracy of the desorption measurements are listed next, based on the microbalance specifications for the range employed. The data acquisition rate of 6 points/min was more than adequate for the slow desorption process. Slower rates were employed for data segments near the plateau region, as noted in the data set documentation. The desorption temperature of 30 °C was selected to provide a temperature near environmental temperatures that could be effectively controlled due to the offset from ambient temperatures of near 25 °C. The flow rate setting was high enough to avoid back condensation and avoided buoyancy effects. The pre-equilibration time was the time required to equilibrate the specimen chamber at 30° so there was a minimum loss of temperature during the 2 min required to open the furnace, load the specimen, and close the furnace. A temperature-programmed ramp to 30° minimized temperature overshoot as the furnace chamber re-equilibrated at 30° after the specimen was mounted on the wired holder within the chamber.

2.3 Chemicals and Materials.

The supercritical carbon dioxide and polymeric materials used are documented in Tables 3-5.

Several categories of material samples were studied in the initial experimentation. One category was based on a survey of materials in sensitive equipment. Another category included thermoplastics tested in previous supercritical carbon dioxide studies to compare the reproducibility of the material sorption process in our laboratory with published data sets. The exact samples employed by others could not be obtained; therefore, better-documented analogs were procured from other sources. Another set of materials was selected from a set of reference materials developed for chemical defense testing. The polymer compositions were those from chemical defense protective equipment that would be brought to and worn at contaminated

sensitive equipment decontamination sites. Materials used in protective masks and gloves were emphasized. The material sources, the codes used to label the material samples, and the source addresses are listed in Table 4. Each material sample source is documented in other tables based on these codes. The itemized sample number is listed, followed by the complete nomenclature, the code, the thickness, and the company source code (see Table 5). Some of the materials in Table 5 were only employed in sorption screening experiments, and detailed desorption diffusion coefficient measurements were not performed on these materials. The subset of the materials with diffusion measurement values are highlighted in Table 5, and the data are listed in the tables in the results section.

Table 2. Experimental Conditions and Specifications Employed for the Desorption Diffusion Coefficient Determination

Variable	Value
Range	0.1 µg to 100 mg
Capacity, total load	5 g
Capacity, weighing	1.0 g
Resolution	0.1 µg
Accuracy	± 0.1%
Data Acquisition rate	6 points/min for the 1st 24 hr; 1 point/min after 24 hr
Temperature, °C	30.00
Flow rate, cc/min	100 (60 + 40)
Pre-equilibration time	> 2 min
Temperature programmed ramp to isothermal	2°/min

Table 3. Carbon Dioxide Sources for Supercritical Experimentation

Instrument	Applied Separations SCG Extractor	Hewlett Packard 7680T
Grade	"Bone-dry"	Supercritical Fluid Extraction, SFE
Purity, %	99.8 minimum	99.99 minimum
Valve	CGA 320	CGA 320
Source	Roberts Oxygen Co., Rockville, MD 20855	BOC Gases, Rivertown, NJ

Table 4. Sources of the Material Specimens Employed in Desorption Experimentation

Material Source	Code	Address
Goodfellow, Inc.	GF	800 Lancaster Ave; Berwyn, PA 19312-1780; (800) 821-2870
Harbor City Plastics	HC	1306 Governor Court; Abingdon, MD 21009
Smithers Scientific Corp.	SS	Smithers Scientific Services, Inc.; 425 West Market Street, Akron, OH 44303-2099; (330) 762-7441 Fax: (330) 762-7447
Resin Kit	RK	1112 River St; POB 509; Woonsocket, RI 02895-0509

Table 5. Polymeric Compositions Employed in Supercritical Carbon Dioxide Interaction Experiments

No.	Polymer Name	Polymer	Nominal Thickness mils	Source Code
1.	Polyethylene, High Density	HDPE		GF
2.	Polyethylene, High MW	HMWPE		GF
3.	Polyethylene, Low Density	LDPE		GF
4.	Polyethylene-propylene	PEP	49	GF
5.	Polytetrafluoroethylene	PTFE		GF
6.	Poly(0.9-styrene-co-0.1-butadiene) Polysar 3350, high impact	PSB	75	GF
7.	Polyvinylidenefluoride, Kynar	PVDF		GF
8.	Polyvinylchloride, unplasticized	UPVC		GF
9.	Polysulfone Thermalux	PSF		GF
10.	Polyvinylchloride, plasticized	PVC	41	HC
11.	Poly(2,6-dimethyleneoxide) Noryl	PPO	34	HC
12.	Polycarbonate Lexan	PC	35	HC
13.	Polymethylmethacrylate Plexiglas	PMMA	39	HC
14.	Acrylonitrile butadiene styrene (20-8-72%) Royalite	ABS	62	GF
15.	Poly(imide) film	PIF	11	GF
16.	Polyetheretherketone	PEEK	20	GF
17.	Polyurethane	PU	42	GF
18.	Poly(oxymethylene) Delrin	POM		GF
19.	Polyethylene terephthalate Mylar	PET		GF
20.	Cellulose –OH) acetate butyrate Uvex	CAB		GF
21.	Polyethylene terephthalate glycol, Vivak	PETG		GF
22.	Polyetherimide Ultem	PEI		GF
23.	Polyamide Nylon66	PA		GF
24.	Poly(isoprene) Natural Rubber	PIP	41	SS
25.	Poly(isobutylene) Butyl Rubber	PIB	41	SS
26.	Poly(bromobutylene) Bromobutyl Rubber	PBB	42	SS
27.	Poly(dimethylsiloxane)	PDMS	47	SS
28.	Silicone Modified Organic polymer (proprietary)	SMO	75	proprietary
29.	Poly(styrene-butadiene) rubber	PSBR	41	RK
30.	Poly(tetrafluoroethylenepropylene) Aflas	PTFEP	38	SS

2.4 Procedures.

2.4.1 Supercritical Exposure Procedures.

The supercritical exposure procedures and conditions employed were based on conditions that were found to successfully remove contaminants from non-sorptive surfaces in previous exploratory experiments (B. MacIver, D. Sorrick; SBCCOM). The supercritical conditions are documented in Table 6. The extraction equipment and cells are documented earlier in this document (see Section 2.1).

Table 6. Comparison of Experimental Conditions for Supercritical Carbon Dioxide Sorption in Polymeric Materials: Measurement Conditions versus Similar Literature[6-8] Conditions

Experimental Conditions	Units	RT#1	RT#2	Literature C3
Pressure	Psig.	1399	1399	2000
Temperature	°, C	50	50	40
Time: Static Extraction @ PT	Min	15	15	60
Time: Decompression	Min	1	1	60
Time: 1st Sorption Weighing	Min	5	20	20

The first column in Table 6 lists the supercritical pressure, temperature, and exposure-time conditions. The second column documents the units. The remaining columns define codes that document the set of experimental conditions in the table. These codes are used in experimental data sheets and computer data file documentation. The difference in RT#1 and RT#2 is only the sorption weighing time; this weighing time at 20 min allows a direct comparison with literature (last column) that reported the first weighing at 20 min.

The extraction time refers to a static exposure without flow through the cell. The decompression time is a rapid but controlled pressure drop to ambient at an approximately linear rate. The "Sorption Weighing" time defines the time lag required to disassemble the cell and manipulate the material specimen to obtain the initial weight. Carbon dioxide desorption under ambient conditions occurred during this lag and can be corrected by an extrapolation back to the end of the decompression period.

2.4.2 Sorption Procedures.

The procedures for exposing the material samples to the supercritical extraction and cleaning process have been documented separately; therefore, these procedures are briefly surveyed in Table 7.

2.4.3 Desorption Procedures.

The procedures for the desorption measurement involve an interleaving of specimen manipulation with software control steps, therefore, these are documented in detail in the Appendix A. A general survey is provided in Table 8.

2.4.4 Kinetic Analysis Data Reduction Procedures.

The basic data sets consisted of time, temperature, and weight measurements. These files were processed by various filtering techniques and data conversions to Fickian parameters. Interim results were processed with custom C++ code based on our previous operational computational methods. A general description of the kinetic data analysis procedure is provided in Table 9. The final computations were performed using custom coded Excel functions, and the documentation is provided in Table 10.

Table 7. Procedures for Supercritical Sorption of Polymeric Materials

Thermoplastic and elastomer sheet specimens were stamped out using 3/8-inch (or other size) hollow punch set (SE Corp.)
Thermoplastic molded specimens were used "as is".
Specimens were pre-weighed, labeled and placed in individual containers.
A set of 3-6 specimens was loaded into a supercritical cell with separation by Whatman GF/A 90mm glass microfibre filter packing sheets for desorption disk specimens and separation by Applied Sciences Polypropylene Wool for other specimen sizes.
Specimen identity was retained by a first-in/first-out sequencing.
Supercritical instrument controls were set for the instrument model employed.
A loaded cell was inserted or connected and the experiment was initiated.
A laboratory stopwatch was started at the end of the decompression step, when the specimen returned to atmospheric pressure.
The supercritical cell was rapidly disassembled in order to weigh the specimen within 4-5 min of the end of the decompression step.
The specimen weight and time after decompression were recorded in a hardcopy data capture version of the spreadsheet.
Specimens were submitted to post-exposure experimentation and the time after decompression was recorded from the stopwatch, for example, diffusion coefficient measurements by TGA (or potentially, for glass transition by DMTA or mechanical properties by Universal Test Machine).

Table 8. Procedures for Desorption Diffusion Coefficient Determination by Thermogravimetric Instrumentation

Standard calibration procedures were completed according to the operations manual
The pre-exposed specimen was weighed on the TGA at 30 °C, removed, and submitted for exposure.
The TGA was programmed to pre-equilibrate at 30° for at least 2 min.
All possible pre-experiment controls were set to minimize the time between loading the desorbing specimen and the start of data acquisition.
After the specimen was removed from the exposure cell, the TGA furnace was opened, the specimen mounted, the furnace closed, and data acquisition initiated.
Stopwatch time was recorded in the TGA remarks field to document the lag time between the end of decompression and the first desorption data point.
Real-time plotting was initiated to allow an estimation of the attainment of a plateau and the presence of extraction by the mass signal falling below the initial mass.
After a plateau was attained, the experiment was terminated, the specimen was transferred from the TGA microbalance to the macrobalance and comparative mass was recorded.
Macrobalance recordings were completed as needed to check for further desorption.
DMTA or other property measurements were performed as a function of specimen weight and desorption time (not reported herein).
Indentation hardness was measured after desorption was complete and compared with values measured on unexposed specimens from the same lot.

Table 9. Kinetic Data Analysis Procedures for Desorption Diffusion Coefficient Calculations

Material identification and the sorption and desorption conditions were stripped from the file headers into the data sheet formats.
Additional material and sorption/desorption experiment documentation were keyed into the data form.
Pre-exposure data and statistics were calculated by the code or internal instrument functions for the diameter, thickness, mass, and indentation hardness.
Exposure data and statistics were calculated: Exposure time, time lag, mean temperature with 95% confidence interval, sorption weight, sorption weight %, sorption weight corrected for extractables, sorption weight % corrected for extractables, indentation hardness with percent change.
Time-temperature-mass data sets were reduced to kinetic parameters by: converting units; converting mass to relative mass; converting lapsed time to absolute time after end-of-decompression; converting time to Fick's Law time$^{(1/2)}$.
Converted data sets were regressed using a Fick's Law relation of Reduced-mass versus Time$^{(1/2)}$ over two regions: High Concentration Region and Low Concentration Region. The high concentration region in the desorption experiment contains the initial diffusion from the swollen polymer surface, not meeting Fick's Law criteria; the low concentration region contains the final diffusion from the depleted and unswollen polymer surface, meeting Fick's Law criteria.
The procedure for selecting the range for the high concentration region consisted of including the coordinate for zero-time and 1.0 Reduced Mass, the initial data acquisition point, then through to the inflection point for deviation from the linear regression fit, usually occurring over a reduced mass range of about 0.65 to 0.55.
The regression was fitted through a single initial zero-time versus 1.0 Reduced Mass coordinate on the y-axis and contained an initial region without data points due to the time lag between decompression and the start of the desorption data acquisition.
The procedure for selecting the range for the low concentration region consisted of including the coordinate for the last data acquisition point through to the inflection point for deviation from the linear regression fit, usually occurring over a reduced mass range of about 0.08 to 0.02.
The low concentration plateau was classified into one of three observed cases and appropriate data reduction procedures were applied for each case, as follows.
Case 1: The plateau occurred near the initial mass and therefore, the absolute and relative reduced masses were similar. The final mass was defined as the initial zero-time mass.
Case 2: The plateau occurred below the baseline for initial mass, indicating extraction had occurred. The last data point was assigned as the final mass for defining the total mass of liquid sorbed and desorbed.
Case 3: The plateau occurred significantly above the initial mass and could not be extrapolated to the initial mass axis in a reasonable time. The final mass was defined as the initial, zero-time mass. (This data reduction procedure ignores the possibility of a tare off-set, however, for the small differences observed between the plateau mass and initial mass, the effect on the results was small)
The low concentration diffusion coefficient equation was used to calculate the time to complete desorption.

Table 10. Equations Employed for Sorption and Desorption Diffusion Data Reduction and Analysis

Cell Number or Cell Range, EXCEL	Documentation
An: File transfer from instrument	Time, min
Bn: File transfer from instrument	Temp, degrees celcius
Cn: File transfer from instrument	TGA mass, mg
Dn = (An * 60)	Converting time in min (An) to time in seconds (Dn)
En = (Dn + M4)	Adjustment to time for extrapolation to "zero" time
Fn = (En / 3600)	Converting adjusted time in seconds (En) to hours (Fn)
Gn = SQRT (En)	Function for Fick's Law square root of time dependence: En^1/2>Gn column
Hn = (((Cn - K8) / K8) * 100)	Converting mass remaining in milligrams to percent using the initial, dry sample mass as the reference mass
In = ((Cn - K8) / (K4 - K8))	Fractional mass desorbed: Column I created from Column C
Jn = (1 - ((K4 - Cn) / (K4 - M8)))	Fractional mass remaining: Column J created from Column C
K4: Cell transfer or from ANALIZ file	Extrapolated mass at zero time
K8: Keyed input or from ANALIZ file	TGA initial, dry mass
K12 = PI() * POWER (((N20 * P20)/4),2)	Computing High Concentration Diffusion Coefficient (HCDC)
K15: Cell transfer	R-Square for regression equation for HCDC calculation
K18 = (-P19) / P20	X-intercept for HCDC
K21: Cell transfer	Y-intercept for regression equation for HCDC calculation
K25 = P19 * K4	Converting y-intercept for HCDC into mass, mg.
L4 = (((K4 - K8) / K8) * 100)	Converting "zero" time mass to wt. %
L8: Cell transfer	Equilibrium mass of desorbed sample, at end of experiment
L12 = PI() * POWER (((N20 * P43)/4),2)	Computing Low Concentration Diffusion Coefficient (LCDC)
L15: Cell transfer	R-Square for regression equation for LCDC calculation
L18 = (-P42) / P43	X-intercept for LCDC
L21: Cell transfer	Y-intercept for regression equation for LCDC calculation
L25 = (POWER (L18,2)) / 3600	Converting x-intercept for LCDC into time, hrs.
M4: Keyed input or from ANALIZ file	Adjustment to account for elapsed time in seconds between sample exposure and start of experiment after sample loading
M8: Keyed input	Minimum mass used for LCDC calculation
M12: Cell transfer	Total mass of liquid sorbed
M25 = (POWER (L18,2)) / 600	Converting x-intercept for LCDC into time, min.

Table 10. Equations Employed for Sorption and Desorption Diffusion Data Reduction and Analysis (Continued)

Cell Number or Cell Range, EXCEL	Documentation
M29: Keyed input	Maximum TGA mass from original TGA data file
M33: Cell transfer	Mass of liquid sorbed based on maximum TGA mass in M29
M37= (M33/K8)/100	Sorption, percent, based on maximum TGA mass in M29
M41 = (((M37 - L4) / L4) * 100)	Relative error, %, of initial 7-12 min sorption value
N4: Keyed input or from ANALIZ file	Shore hardness scale
N8: Keyed input or from ANALIZ file	Pre exposure hardness
N12: Keyed input or from ANALIZ file	Post desorption hardness at time
N16 = (((N12 - N8) / N8) * 100)	Change in hardness, %, after exposure and desorption
N20: Cell transfer	Mean thickness, cm.
N22: Copy-paste input	Original TGA data filename
N25: Cell transfer	X-intercept for LCDC as a time in min
N29: Keyed input	Adjusted TGA mass for 20 min elapsed time from exposure
N33: Cell transfer	Mass of liquid sorbed based on 20 min elapsed time in N29
N37 = (N33/K8) * 100	Sorption, %, based on N33
N41 = (((N37 - L4) / L4) * 100)	Relative error, %, of 20 min literature sorption value
P19: Cell transfer from regression cell	Y-Intercept Diffusion Coefficient from HCDC regression equation
P20: Cell transfer from regression cell	Slope from regression equation for HCDC calculation
P42: Cell transfer from regression cell	Y-intercept Diffusion Coefficient from LCDC regression equation
P43: Cell transfer from regression cell	Slope from regression equation for LCDC calculation

3. RESULTS

3.1 Supercritical Carbon Dioxide Sorption and Desorption Data for Polymeric Materials.

An example of a plot of time versus desorption diffusion mass loss is shown in Figure 1. In this example for poly(styrene-butadiene) (PSB) thermoplastic, the desorption process is well behaved, and the carbon dioxide loss plateau is approaching the zero-time baseline. The full compilation of data sets is provided in Appendix B. Subsets of the data are organized in tables in the following section to allow an evaluation of trends in the data as a function of experimental and data reduction techniques.

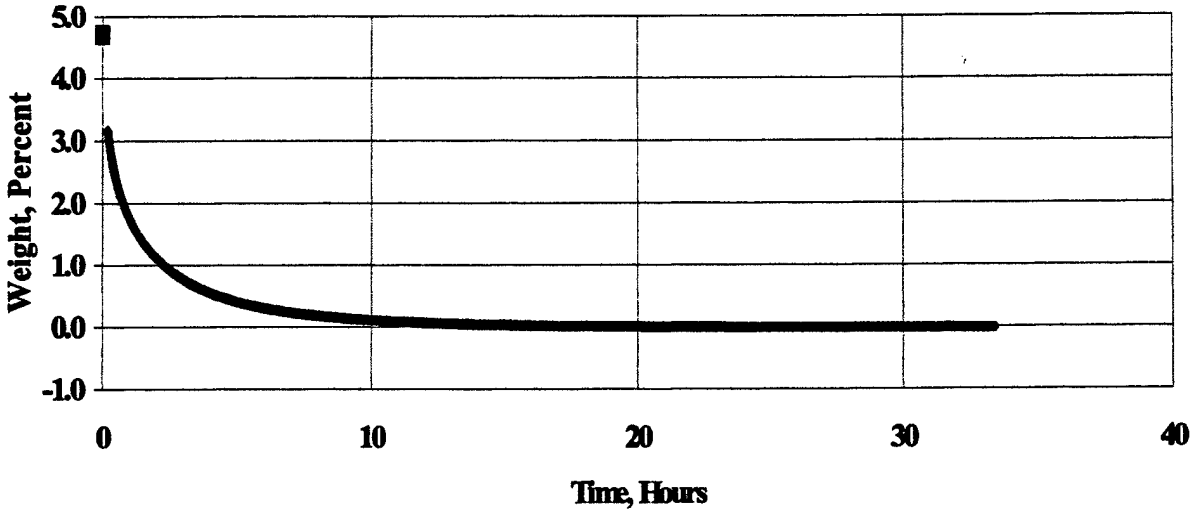

Figure 1. Desorption Diffusion (30 °C) of Supercritical Carbon Dioxide from Polymeric Materials: PSB (0140d)

3.2 Sorption Values Corrected for Fraction Extracted Employing Equilibrium Desorption Measurements.

The sorption results in Table 11 are corrected for the fraction of mobile additives in the material that were extracted during the supercritical exposure. Poly(isoprene), PIP in Figure 2, is an example of a polymer containing mobile additives that appear to be partially extracted; the carbon dioxide desorption plateau is below the original baseline providing a measurement of the fraction extracted. The positive 'Extracted, %' values in column 5, Table 11, denote the desorption diffusion data plateaued below the initial baseline and indicated a net extraction. The (+/-) sign convention is reversed in evaluating the raw mass data, because the mass values below the zero baseline are negative when net extraction takes place. The magnitude of the fraction extracted is programmed into the data reduction procedures to calculate the corrected sorption. The value for the corrected sorption, based on the fraction extracted (in the third column of the table), is followed by the uncorrected sorption value. The relative error due to ignoring the extractables is calculated in the last column. Note that experimentation that ignores the extraction of the additives in the material causes considerable error that would change the relative ranking of materials for resistance to supercritical carbon dioxide sorption. The 'Not Applicable' entry refers to materials in which there was no measurable extraction. The methodology was capable of ranking the relative sorption levels for the spectrum of materials. The corrected sorption value was required to correctly rank the materials. The general trend in supercritical carbon dioxide was slightly influenced by fraction extracted. For the combination of low sorption and high extractables (e.g., PEEK), the relative error was high but the ranking was only slightly influenced.

Table 11. Supercritical Carbon Dioxide Sorption (%) into Polymeric Materials Based on Correction for Fraction Extracted: Conditions of 1400 psig and 50 °C after 15 min

No.	Polymer Codes	Sorption, Corrected, %	Sorption, Uncorrected, %	Extracted, %	Relative Error, %
1.	PDMS, 139d	0.44	0.44	-0.03	Not Applicable
2.	PIF, 0151z	1.09	0.21	0.88	-80.7
3.	PVC, 0089d	1.47	1.47	-0.03	Not Applicable
4.	PEEK, 154z	1.49	1.20	0.28	-18.8
5.	PVC, 0110z	1.65	1.65	-0.02	Not Applicable
6.	PTFEP, 153z	2.39	2.24	0.15	-6.3
7.	PC, 0082d	2.46	2.36	0.10	-4.1
8.	PC, 0117d	2.62	2.49	0.13	-5.0
9.	PBB, 0138d	3.12	3.00	0.12	-3.8
10.	PEP, 0130d	3.22	3.11	0.11	-3.4
11.	PPO, 0091d	3.64	3.64	-0.24	Not Applicable
12.	ABS, 0115d	3.75	3.72	0.03	-0.8
13.	PIP, 0131d	4.12	3.39	0.73	-17.7
14.	PPO, 0096d	4.29	4.29	-0.17	Not Applicable
15.	PSB, 0140z	4.72	4.70	0.01	-0.2
16.	SMO, 0129d	4.94	4.94	-0.20	Not Applicable
17.	PMMA, 075z	5.83	5.83	-0.90	Not Applicable
18.	PMMA, 105z	6.24	6.24	-0.22	Not Applicable
19.	PU, 0124d	7.08	6.80	0.28	-4.0
20.	PSBR, 143z	7.32	6.58	0.74	-10.1
21.	PIB, 0137d	7.88	7.88	-0.13	Not Applicable

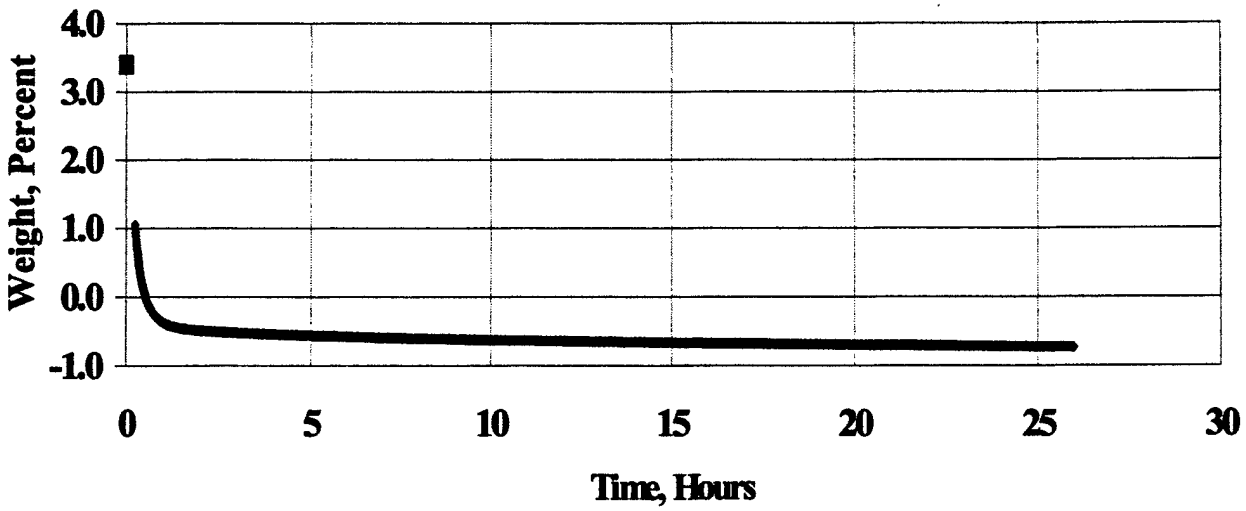

Figure 2. Desorption Diffusion (30 °C) of Supercritical Carbon Dioxide from Polymeric Materials: PIP (0131d)

Replicate specimens of PC, PVC, and PPO had reproducible 'Extractables' and 'Corrected Sorption Values' (columns 5 and 3 respectively, Table 11). The PMMA Extractible values were dissimilar, but small relative to the sorption, therefore, the rankings were identical. Note that the reproducibility and accuracy of the extractible determination is dependent on the attainment of a plateau in the continuous microbalance desorption process. Alternatively, the specimen mass could be determined after a longer period by removal from the continuous microbalance monitoring instrument and weighing on an independent macrobalance. This would also reduce the specimen residence time in the microbalance and increase specimen throughput.

About half of the materials had significant extractables under the processing conditions. Therefore, the migration of extractables cannot be ignored in the evaluation of material compatibility. The extractible adjustment is a systematic error that underestimates the true $SCCO_2$ sorption value. Furthermore, this error is not a constant offset for all materials and is shown here to vary considerably with polymer structure and formulation.

3.3 Comparison of Sorption Values with Correction to Zero-time Mass Based on High Concentration Desorption Extrapolations.

Most of the sorption values reported in the literature are based on an initial measurement that is often performed after considerable desorption has occurred. This desorption occurs between the time the specimen is removed from the liquid and the initial weighing; the more volatile the liquid the higher the systematic error. Supercritical carbon dioxide is an even greater experimental challenge because the true equilibrium sorption value exists at elevated temperature and pressure. The decompression period adds further uncertainty regarding the zero-time value in desorption kinetics. The end of the decompression period was arbitrarily

defined as the zero-time because we were able to hold the time-to-decompress from high to ambient pressure to a fixed 1-min interval. If the decompression period was variable, the start of the decompression process would be a better kinetic zero-time.

Figure 3 provides a Fick's Law plot of time$^{(1/2)}$ versus reduced mass showing the extrapolation back to an adjusted zero-time sorption value for poly(isobutylene) (PIB). The back extrapolation for this elastomer is characteristically long, however, rapidly sorbing and desorbing polymers such as PDMS are even more extreme.

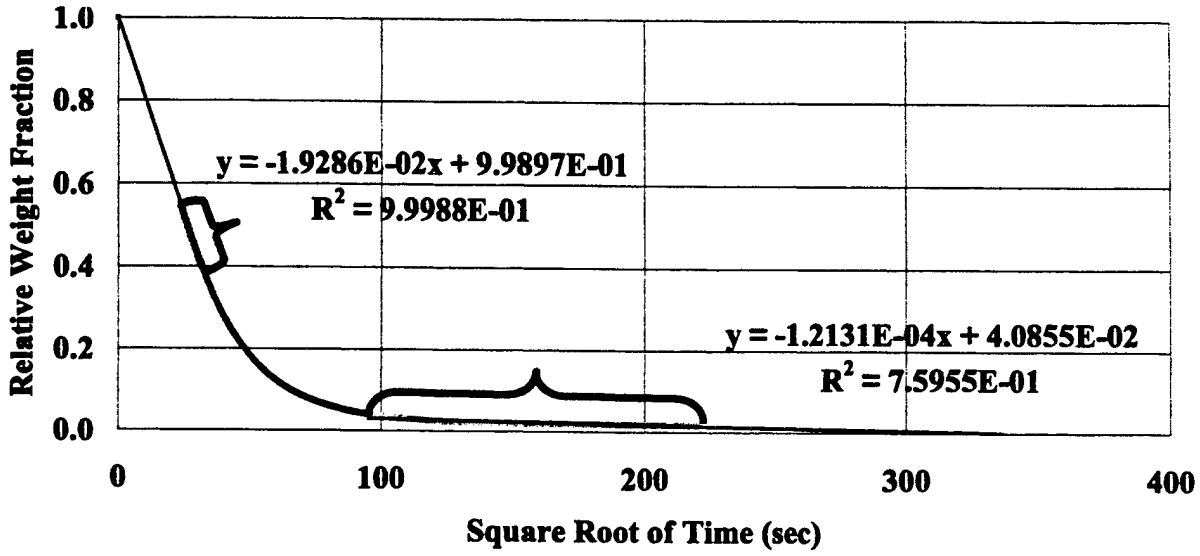

Figure 3. Fick's Law Plot of Desorption Diffusion (30 °C) of Supercritical Carbon Dioxide from Polymeric Materials: PIB (0137d)

Due to this lag before the initial sorption measurement, the traditional reported measurements give systematically low sorption values that underestimate the actual degree of interaction and solubility of fluids such as supercritical carbon dioxide in materials. In Table 12, the 'zero-time corrected sorption' values are calculated, followed by the error in ignoring the desorption during the 7 to 12-min TGA experiment and the 20-min measurement delay.[6-8] Large systematic relative errors of –15 to –86% were suffered by ignoring the extrapolation to zero-time. The methodology was capable of correcting for this measurement time lag after decompression and improving the ranking the materials. One can observe from the last two columns that there would be large ranking errors and polymer-fluid interaction errors from not employing the methodology for extrapolating to the end-of-decompression. The replicates of PVC, PC, and PMMA showed good sorption reproducibility, whereas PPO replicates had a larger difference of 3.75 versus 4.3% or standard deviation of 6.7% relative.

Table 12. Comparison of Sorption (%) Corrected for Extrapolation to Zero-time at the end of the Decompression Period Versus Uncorrected Sorption after 7-12 min and 20 min (6-8)

No.	Polymer Codes	Sorption, Zero-time Corrected	Sorption at 7-12 min, % (Relative Error, %)	Sorption at 20 min, % (Relative Error, %)
1.	PDMS, 139d	0.44	0.13 (-70.3)	0.06 (-86.8)
2.	PIF, 0151z	1.09	0.16 (-22.5)	0.04 (-80.0)
3.	PVC, 0089d	1.47	1.16 (-21.3)	1.05 (-28.8)
4.	PEEK, 154z	1.49	0.78 (-34.7)	0.60 (-50.3)
5.	PVC, 0110z	1.65	1.37 (-17.2)	1.20 (-27.2)
6.	PTFEP, 153z	2.39	1.68 (-24.7)	1.31 (-41.3)
7.	PC, 0082d	2.46	1.85 (-21.5)	1.48 (-37.1)
8.	PC, 0117D	2.62	1.85 (-25.8)	1.48 (-40.5)
9.	PBB, 0138d	3.12	1.41 (-52.8)	0.90 (-70.0)
10.	PEP, 0130d	3.22	1.53 (-50.7)	0.93 (-70.0)
11.	PPO, 0091d	3.64	2.57 (-29.5)	1.97 (-45.7)
12.	ABS, 0115d	3.75	2.86 (-23.2)	2.37 (-36.3)
13.	PIP, 0131d	4.12	1.08 (-68.2)	0.60 (-82.4)
14.	PPO, 0096d	4.29	2.74 (-36.1)	2.05 (-52.2)
15.	PSB, 0140d	4.72	3.32 (-29.3)	2.76 (-41.4)
16.	SMO, 0129d	4.94	3.92 (-20.8)	3.50 (-29.2)
17.	PMMA, 075z	5.83	4.82 (-17.3)	4.30 (-26.2)
18.	PMMA, 105z	6.24	5.26 (-15.7)	4.67 (-25.2)
19.	PU, 0124d	7.08	5.07 (-25.5)	4.19 (-38.4)
20.	PSBR, 143z	7.32	3.67 (-44.3)	1.87 (-71.6)
21.	PIB, 0137d	7.88	4.36 (-44.7)	2.72 (-65.5)

3.4 Time for Complete Desorption and Reuse of Sensitive Equipment after Exposure Employing Fick's Law Low Concentration Diffusion Equations.

It is important to establish the time required for complete desorption of all carbon dioxide from the material before equipment can be reused after decontamination. Residual decontaminant such as carbon dioxide or fluorocarbon cleaning fluids can plasticize the polymer and decrease certain properties that might cause failure under use conditions. The ability of the measurement and data reduction process to provide this type of "time for complete desorption" values is demonstrated in Table 13. The continuous measurement of desorption allowed the best possible estimate of the time to complete desorption because the high data densities provided robust extrapolations to the time required for the material specimen to regain its original weight. The approach to this final equilibrium can be extremely slow, however, and the continuous, high data densities combined with a Fick's Law diffusion coefficient allowed extrapolation to the time axis zero-mass values.

An example of a Fick's Law plot for Silicone Modified Organic (SMO) polymer is shown in the Figure 4. The mass has been normalized from 0 to 1 on the y-axis and the Fickian time$^{(1/2)}$ is employed on the x-axis. The Fick's Law equations for the linear portion of

the initial and final desorption are shown adjacent to their respective section of the plot. The thinner line denotes the extrapolated section of the curve at both extremes of the plotted data. One can see the extrapolation to zero-time on the x-axis that defines the time-to-complete-desorption; this value can be used to specify the time-to-reuse for decontaminated items.

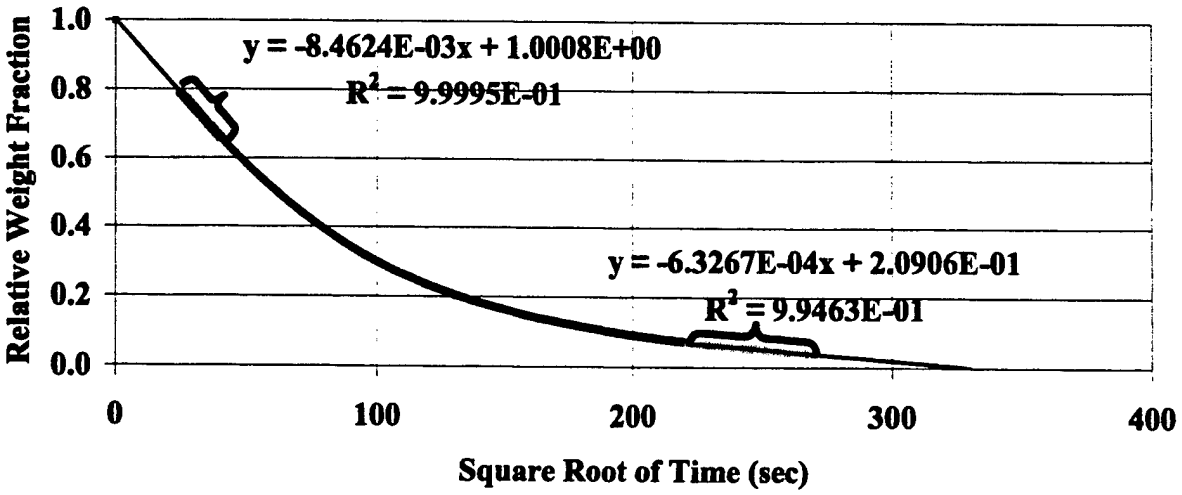

Figure 4. Fick's Law Plot of Desorption Diffusion (30 °C) of Supercritical Carbon Dioxide from Polymeric Materials: SMO (0129d)

The time for complete desorption is reported, followed by the Fickian diffusion equation and diffusion coefficient in the last two columns of Table 13. One can see that the methodology is capable of ranking the materials based on the time required to return to the unplasticized condition after super critical carbon dioxide exposure. For the materials studied, this period ranged from about 1 to 5 days.

The calculation of an extrapolated time to complete desorption can be sensitive to several processes influencing the data near the initial baseline, which are the presence of mobile extractables in the materials and the length of the experiment and degree to which the decontaminant has approached a plateau. Desorbing polymers with shorter experiment times that are not close to the baseline require longer extrapolation periods, increasing the potential error. The permutations of categories of data sets have been organized according to the following two processes:

- the low concentration desorption can be at a zero plateau or continuing to decrease toward a desorption mass change plateau

- the final mass relative to the baseline can be near zero, below zero (indicating extraction has occurred), or above zero (indicating the desorption was so slow the experiment had to be terminated before nearing complete desorption). The number of polymers in the various combinations of these two conditions have been tabulated and reported in Table 14.

Table 13. Time for the Complete Desorption of all Carbon Dioxide from Polymeric Materials Based on a Fick's Law Extrapolation of Low Concentration Desorption Diffusion

No.	Polymer Codes	Time for Complete Desorption hrs (days)	Fickian Diffusion Equation: Relative Mass Fraction =	Diffusion Coefficient, cm^2/sec
1.	PEP, 0130d	20.6 (0.9)	$0.038 - 1.38E\text{-}4\ time^{(1/2)}$	5.7250E-11
2.	PU, 0124d	20.7 (0.9)	$0.050 - 1.83E\text{-}4\ time^{(1/2)}$	7.5549E-11
3.	PTFEP, 153z	22.4 (0.9)	$0.083 - 2.92E\text{-}4\ time^{(1/2)}$	1.5448E-10
4.	PBB, 0138d	23.5 (1.0)	$0.056 - 1.91E\text{-}4\ time^{(1/2)}$	7.9684E-11
5.	PSB, 0140d	24.2 (1.0)	$0.042 - 1.44E\text{-}4\ time^{(1/2)}$	1.4751E-10
6.	PIP, 0131d	24.4 (1.0)	$0.070 - 2.38E\text{-}4\ time^{(1/2)}$	1.2030E-10
7.	PVC, 0089d	29.1 (1.2)	$0.288 - 8.90E\text{-}4\ time^{(1/2)}$	1.5727E-09
8.	SMO, 0129d	30.3 (1.3)	$0.209 - 6.33E\text{-}4\ time^{(1/2)}$	2.8522E-09
9.	PIB, 0137d	31.5 (1.3)	$0.041 - 1.21E\text{-}4\ time^{(1/2)}$	3.0844E-11
10.	PEEK, 154z	38.7 (1.6)	$0.163 - 4.38E\text{-}4\ time^{(1/2)}$	9.4139E-11
11.	PSBR, 143z	40.5 (1.7)	$0.081 - 2.11E\text{-}4\ time^{(1/2)}$	9.3694E-11
12.	ABS, 0115d	42.8 (1.8)	$0.124 - 3.15E\text{-}4\ time^{(1/2)}$	4.8703E-10
13.	PI, 0151z	46.4 (1.9)	$0.363 - 8.88E\text{-}4\ time^{(1/2)}$	1.1647E-10
14.	PMMA, 075z	53.8 (2.2)	$0.433 - 9.84E\text{-}4\ time^{(1/2)}$	1.8087E-09
15.	PC, 0117d	57.9 (2.4)	$0.119 - 2.60E\text{-}4\ time^{(1/2)}$	1.1518E-10
16.	PVC, 0110z	60.0 (2.5)	$0.175 - 3.77E\text{-}4\ time^{(1/2)}$	3.2042E-10
17.	PPO, 0091d	61.2 (2.5)	$0.151 - 3.22E\text{-}4\ time^{(1/2)}$	1.6204E-10
18.	PPO, 0096d	66.8 (2.8)	$0.092 - 1.88E\text{-}4\ time^{(1/2)}$	5.0719E-11
19.	PC, 0082d	72.2 (3.0)	$0.099 - 1.94E\text{-}4\ time^{(1/2)}$	5.7604E-11
20.	PDMS, 139d	83.0 (3.5)	$0.110 - 2.02E\text{-}4\ time^{(1/2)}$	1.1404E-10
21.	PMMA, 105z	130.1 (5.4)	$0.199 - 2.90E\text{-}4\ time^{(1/2)}$	1.6240E-10

Table 14. Number of Polymeric Materials in Various Cases Based on Desorption Relative to the Baseline and a Decrease or Plateau Approaching the Baseline

Case Code	Low Concentration Desorption Relative To Zero Baseline	Plateau or Decreasing Desorption Approaching the Baseline	Number of Polymeric Materials in Case, (% of Total)
NZP	Near Zero	Plateau	2 (9.5%)
NZD	Near Zero	Decreasing	1 (5%)
BZP	Below Zero	Plateau	3 (14%)
BZD	Below Zero	Decreasing	7 (33%)
AZP	Above Zero	Plateau	2 (9.5%)
AZD	Above Zero	Decreasing	6 (29%)

Most of the data reduction challenges from the diverse types of desorption plots were handled by the calculation procedures outlined in Table 9, with respect to assigning Case 1, 2, or 3 to the procedures. The NZP case in Table 14 is the simplest to analyze because the extrapolated time to complete desorption almost lies on the reduced mass plot. Likewise, the NZD case only requires a short extrapolation. Together, these only account for about 15% of the materials. About 47 % of the materials desorbed to below the zero mass baseline, indicate some extractables were present. These cases present a problem in defining the last mass data point for the reduced mass calculation. The BZP data sets can be handled by regressing that portion of the data set parallel to the baseline to define the onset of deviation from this plateau. This mass-time point would then be defined as the end of the desorption process. The low concentration diffusion would then be based on the Fickian regression of the last 3-10% of the data set above this reduced mass. The AZP cases are estimated to be caused by a shift in the specimen position and baseline. Again, this data case was handled by regressing that portion of the data set parallel to the baseline to define the onset of deviation from this plateau. The AZD case consists of materials with slow desorption for which the experiment was terminated early to increase the productivity of the instrument. If the data set did not extend to about 5% reduced mass remaining, the decontaminant-material might not have been in the low concentration Fickian region, and the extrapolation would lead to systematically low time-to-complete desorption. This case is best handled by repeating the experiment and establishing a criterion for terminating all experiments at less than about 5% mass remaining.

- Replicates. Measurement replicates and an analysis of reproducibility were not planned for this initial stage of the investigations; however, several paired specimens were evaluated to obtain some preliminary indications on trends or difficulties in data analysis. Four specimen pairs were evaluated: PVC, PMMA, PPO, and PC, and each is discussed below.

- PVC. The desorption time difference between the PVC repetitions is relatively high. Inspection of the Fick's Law and reduced mass versus time plots show a smooth, well-behaved approach to zero mass for both specimens. The PVC specimen with the longer desorption time had the higher initial carbon dioxide sorption (1.65 > 1.47%), and some part of the longer time might be attributed to this higher carbon dioxide content. The preferred PVC desorption time is the mean of 1.85 days.

- PMMA. A parallel comparison of the PMMA replicates yields a relatively high desorption time difference. Inspection of the low concentration Fick's Law diffusion extrapolation shows the lower desorption was produced by an extrapolation from about 20% from the baseline, whereas the longer complete desorption time extrapolation was from about 5%. Therefore, the 5.4 day "Time to Complete Desorption" is the preferred value (PMMA 105z). The longer desorption time was also from the specimen with the higher initial sorption value (6.4>5.8%).

- PC. The PC comparison of replicates shows a relatively small difference in initial sorption and desorption time. The Fick's Law plots overlay closely, even though there was balance instability at several time intervals (in PC 0082d). Because both replicates qualify as a statistical sample, the mean time of 2.7 days is the preferred value.

- PPO. The PPO replicates belong to the AZP case; the curves came to a plateau slightly above the zero-mass baseline. The low concentration diffusion coefficient regression and extrapolation was heavily weighted by a large fraction of the data set with a significant, nominal positive mass. The "time to complete desorption" was, therefore, erroneously extended to longer time values. This case was handled by regressing the plateau portion of the data set parallel to the baseline to define the onset of deviation from this plateau. The onset of deviation was defined as the end of the desorption data set, and the low concentration regression was calculated from to onset to 3-10% higher residual mass values. The revised extrapolations are reported in Table 14. This data reduction procedure resulted in much closer agreement between replicates (2.5 versus 2.8 days). These data analysis procedures are being formalized for future studies but have not been auto-programmed into the data reduction software since some degree of judgment is still required.

3.5 Indentation Hardness.

Chemical exposure often influences the surface properties of materials that are critical to their performance. Indentation hardness is one of the most important of these surface properties. The values of the unexposed baseline measurements were compared with values after exposure and are documented in Table 15. About a third of the materials exposed to supercritical carbon dioxide showed surface hardening of about 1 to 3%. Another one-third experienced surface softening of over ca 1%. Note that the measurement shows the relatively low level of surface change after the plasticizing supercritical fluid had completely desorbed; measurements performed while a significant fraction of the decontaminant was still present resulted in larger changes. The methodology was capable of ranking the materials based on these longer-term indentation effects.

4. DISCUSSION

Sorption and desorption diffusion coefficient measurements by TGA were useful in characterizing the plasticization of polymeric materials by supercritical carbon dioxide.[9] The sorption value measured includes solubility and void pressurization. The diffusion coefficient equations allowed a calculated estimate of the time required to return to the unplasticized state. The time determined to return to the initial unplasticized weight does not include the potential effects of residual trace carbon dioxide on glass transition temperature and crystallinity. Dynamic Mechanical Thermal Analysis (DMTA) studies of these effects as a function of desorption time are in progress. Indentation measurements showed slight changes after complete desorption. The continuous desorption curve measurement allowed adjustment and correction for extractables and the zero-time sorption measurement-lag after decompression; these corrections eliminated very high relative errors for many polymers.

The low concentration diffusion coefficient is sensitive to the interpretation of the plateau value near the zero baseline. The slope and diffusion coefficients have very low values of 10^{-9} to 10^{-10} cm^2/sec for carbon dioxide. Therefore, the offset from the zero baseline due to extractables or slow equilibration will influence the extrapolations to a time-axis intercept. The goal is a set of data reduction procedures independent of operator interpretation. This process has been initiated by formulating several data analysis cases and rules, provided in Table 9 and 14.

Table 15. Indentation Hardness Changes to Polymeric Materials after Exposure to Supercritical Carbon Dioxide, Followed by Complete Desorption: Exposed to 1400 psig at 50 °C for 15 min

No.	Polymer Codes	Scale	Baseline	Final	Change, %
1.	PVC, 0110z	Shore D	ND	ND	ND
2.	PSB, 0140d	Shore D	63.6	45.8	-28.0
3.	PVC, 0089d	Shore D	73.4	71.5	-2.6
4.	PC, 0082d	Shore D	76.5	75.1	-1.8
5.	PMMA, 105z	Shore D	82.0	81.0	-1.2
6.	PC, 0117d	Shore D	76.9	76.1	-1.0
7.	PMMA, 075z	Shore D	80.2	79.5	-0.9
8.	PTFEP, 153z	Shore A	91.7	91.2	-0.5
9.	PIF, 0151z	Shore D	82.5	82.2	-0.4
10.	PU, 0124d	Shore A	96.9	97.0	0.1
11.	PEP, 0130d	Shore A	93.6	93.9	0.3
12.	PPO, 0096d	Shore D	75.6	75.8	0.3
13.	PPO, 0091d	Shore D	76.2	76.6	0.5
14.	SMO, 0129d	Shore A	58.6	58.9	0.5
15.	PEEK, 154z	Shore D	76.4	77.0	0.8
16.	ABS, 0115d	Shore D	72.6	73.4	1.1
17.	PSBR, 143z	Shore A	85.8	87.1	1.5
18.	PDMS, 139d	Shore A	63.9	64.9	1.6
19.	PIB, 0137d	Shore A	66.2	67.7	2.3
20.	PIP, 0131d	Shore A	66.9	68.7	2.7
21.	PBB, 0138d	Shore A	65.9	67.8	2.9

The sorption measurement desired is the value under supercritical conditions, however, the ability to measure values under these pressure and temperature conditions is currently limited. The relatively rapid 1-min decompression time maximizes our ability to measure the sorption as quickly as feasible. The ability to analyze polymer trends was confounded by attempting to use the sorption values without the corrections determined here. With these adjusted values, sorption trends can be correlated with structure, polymer solubility phase diagrams, or solvent-solute parameters. These correlations will assist in the selection of the optimal solvent class (supercritical or fluorocarbon) or temperature and pressure conditions. Classes or categories of materials that can or cannot withstand the cleaning process can also be identified. The further evaluation of the results can be provided in future publications.

There is an overall need for a measure of the desorption time required to deplasticize a material from sorbed decontaminant chemicals and return the material to its initial glass transition temperature and material properties that are dependent on plasticization and glass transition temperature. The diffusion measurements reported herein might be further exploited to provide a generalized limiting measure of the most rapid desorption feasible for any future decontaminant, because carbon dioxide is a favorable molecular prototype in terms of low

molecular cross-section. Therefore, most liquids such as fluorochemicals and solvent-based decontaminants (Decon Green) should have higher molecular cross-sections and slower returns to the initial glass transition temperature.

5. CONCLUSIONS

A methodology was developed and applied for evaluation of desorption diffusion of decontamination extractants such as supercritical fluids and fluorocarbons. The instrumentation and methods were capable of ranking polymeric materials based on interaction with supercritical carbon dioxide for several types of measurements. These measurements included: sorption, corrected for fraction of polymer additives extracted; sorption, corrected for extrapolation to the end of decompression; time for complete desorption to the initial weight; low-concentration diffusion coefficient; and change in surface indentation hardness.

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APPENDIX A

COMPUTERIZED PROCEDURES

Table Desorption Experiment Procedures for Thermogravimetric Instrumentation

Purpose	Steps
Initiate TA2100 Data acquisition	Reboot PC: Ctrl-Alt-Del Key F1 to select TGA mode Key F5 to Reconfigure, if needed ESC to enter Main Menu
Zero the empty specimen holder	Select F6: Signal Control Select: F1 Autozero
Weigh the specimen before chemical exposure	Open Furnace, insert specimen, close furnace Record weight on spreadsheet Remove specimen and submit to chemical exposure
Display and edit experimental parameters	Select F12 Instrument Control Select F4 Experimental Parameters Select Sample Info Select F1 Edit sample experimental parameters Scroll through and key in values Select F8 Accept Form ESC to Main Menu
Display and edit Method parameters	Select F2 Method Scroll to select Method ESC to finalize selection and return to Menu
Pre-equilibrate oven to desorption temperature	Select F1 Start
Pre-desorption experimental preparation	Key F12 Instrument Control Key Signal Control Key F1 Autozero Key F12 Instrument Control Key F3 Reject and Yes to end equilibration
Load chemically exposed specimen for desorption	Weigh specimen on Macrobalance Open furnace, load specimen, close furnace F4 to enter Elapsed time, Initial weights F1 Esc to Main Menu F1 Start
Display plot of data	Select F8 Utilities Select F1 Directory Select F3 Esc
Update Data plot	F7 New Data Limit F1No Limit

Table Data Analysis File Transfer Procedures

Purpose	Steps
File transfer from TA2100 to DOS on same PC	• **Reboot PC to exit TA2100: Alt-Ctrl-Del** • Insert diskette for data file • F2 key to select DOS
Copy binary file from TA2100 directory to DOS directory	• Key "tadir data" DOS command to list TGA data files • Note filename for transfer • Key "taget filename" >"1 File copied"
Convert DOS binary to ASCII format	• Key 'taconvrt", Enter; key in at prompt: "Name of binary TA data file:" • Key "filename.0#)" (pmma0123d.01) • ASCII: filename.01a (pmma0123d.01a) • Parameter Block: Key Yes
Filter data set by selecting the range and averaging set	• Data size: 1 (=All data) • Data points: 3 (Least Square Average groups of N points) • Key point number (e.g. 50 for a plot, 3-9 for calculations) • Wait for prompt > • Control-C to return to DOS Prompt
Transfer file to diskette	• Key "copy filename.01a a:"
Transfer file from diskette to PC with the Diffusion Coefficient Data Analysis Program	• Highlight and Drag filename from a: diskette to DATA and ANALYSIS Folders
Convert data filename to code recognized by ANALIZ diffusion coefficient calculations	• Open Analysis Folder, then open *polymer.ini* • Create a New line at the end of the file, but before the end-of-file control character. • Key in next Material Code by incrementing the current Code number • Document the Material nomenclature employing conventions and delimiters • Click File, Save
Rename the TGA data file to the coded ANALIZ filename	• Open Analysis Folder • Highlight TGA filename, • Key in coded name
Convert TGA file to Coded ANALIZ file structure	• Highlight Coded filename, • Select Open in Word for large files • Delete first 20 lines of header parameters, • Delete any blank lines at top of data file, Delete any non-data lines at end of data file, • File>Save, • Select "Text document" (ASCII without control characters) • Close

Table Data Analysis File Transfer Procedures (Continued)

Purpose	Steps
Input specimen data for diffusion calculations	• Open INPUT database form; • Key in coded filename, • Check that the correct polymer nomenclature is displayed. • Key in specimen parameters as prompted,
Set temporary value for initial weight at desorption zero-time	• Key in the highest weight value from TGA plot or TGA data file
Complete the input portion of the database form	• Last input: "Time lapsed between sample blotting and loading" Or "Initial Durameter Hardness" when available; • File>Save>Close
Check for the creation of the correct file.dta filename in Analysis Folder	• Open Analysis Folder or use Explorer>Find

Table Procedure for Calculation of Diffusion Coefficients

Purpose	Steps
Calculate the extrapolated weight at zero-time for desorption: Sample weight when removed from exposure fluid	• Run ANALIZ • Key in filename (##-#-#) • Examine 2 plots displayed • Examine the data near the early data points for a linear region to use for the extrapolation • Examine the lower plot of the entire data set for anomalies • Key Enter/Any
Define data range used for extrapolation	• Examine the Weight versus Square Root of Time plot • Click on 2 points in the early desorption data; range lines appear after the second click • Key Enter
Select the Extrapolated Weight at zero-time	• Observe the display of regression parameters • Determine if the y-intercept value is reasonable • Key in a weight at zero-time at the prompt • Key Enter, Control-C to exit
Input the Extrapolated weight at zero-time into INPUT database	• Open INPUT • Open filename ##-#-# • Scroll to "Initial Weight of Specimen" • Key in weight from y-intercept extrapolation • File>Save
Set up calculation of diffusion coefficients using extrapolated weight at zero-time	Open ANALIZ Open filename Key in Extrapolated weight again

Table Procedure for Calculation of Diffusion Coefficients (Continued)

Purpose	Steps
Select the range of desorption data for calculation of the diffusion coefficient by Method 1	• Examine plot for linear Fickian region • Key in "Yes" if there is a linear region for the calculation of a diffusion coefficient; for the Question Prompt: Is the plot Fickian? • Key in values to define the calculation range in terms of fractional weight remaining • Click on a high and low coordinates to define the range; repeating or altering the Keyed-in ranges • Key in Enter
Select ranges for Method 2, Low Concentration diffusion coefficient	• Examine the plot of the last 20% of the weight loss recorded; note, the relative weight might not include the complete curve • Click on 2 coordinates on the plot to define the range
Select ranges for a Series Solution for the diffusion coefficient	• Examine the plot of the natural log relative weight versus time • Click on 2 points for calculation of an initial extrapolated weight • Examine the replotted data set for selection of a linear range • Click on 2 coordinates on the plot to select the range for the Series Solution calculation
Record calculated results from the display	• Document value: "Time at 99% desorption flux", since this value is not printed from INPUT database
Document diffusion coefficient calculations	• Open INPUT database • Select filename from File>Open • Print INPUT database form from File>Print • Exit

APPENDIX B

DESORPTION DIFFUSION COEFFICIENT DATA SETS AND COMPUTATIONS

FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Polycarbonate PC

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	04-1-1	TGA Filename:	pc0082d
Property Test Specification:	ASTM D471/D543		
Material Name:	Polycarbonate	Material Code:	PC
Material Supplier:	Harbor City Plastics	Material Class:	TP
Monomer Source:	General Electric	Base Polymer (Lot. No.):	(LBR567)
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	1

Pre-Exposure Data

Measured Diameter (mm):		10.20	10.08	10.02	10.17	
Mean Diameter:	10.118			95% Confidence Level (CL):		0.131
Measured Thickness (mils):		34.60	35.20	34.80	34.80	
Mean Thickness:	34.850			95% Confidence Level (CL):		0.400
Initial Sample Weight (mg):		79.822				
Initial Durometer Hardness:		76.5	Scale: SHORE		D	

Sample Exposure Data

Exposure Date:	03/22/00	Time:	11:33:00
Removal Date:	03/22/00	Time:	11:48:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	81.70
Weight Gain (mg):	1.88	Percent Weight Gain:	2.36
Final Durometer Hardness After Desorption:	75.1	Percent Hardness Change:	-1.8

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.000	95% CL:	0.0007
Time Lapse Between Sample Exposure and Sample Desorption (sec):			480
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			79.740
Sample Extracted (mg): 0.08	Solubility Corrected for Extractables (mg):		1.96
Sample Extracted (%): 0.10	Solubility Corrected for Extractables (%):		2.46

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm^2/sec):			1.6572E-07
Range Including Intercept (0,1), Relative Weight Fraction:			1.00 - 0.65
Linear Range of Desorption, Relative Weight Fraction:			0.78 - 0.65
Slope:	-1.0379E-02	X-axis Intercept:	9.6722E+01
R Square:	0.99504	Y-axis Intercept:	1.0038E+00

Low Concentration Diffusion Coefficient (cm^2/sec):			5.7604E-11
Linear Range of Desorption, Relative Weight Fraction:			0.05 - 0.00
Slope:	-1.9350E-04	X-axis Intercept:	5.0965E+02
R Square:	0.85851	Y-axis Intercept:	9.8616E-02

Wt. @ Zero Time, mg	Wt. @ Zero Time, %	Adjustment to TGA Time, sec	Hardness Shore Scale
K	L	M	N
81.70	2.353	480	D
TGA Dry Wt., mg	Equil. Wt. Of Desorb. Sample	Min. Wt. Used For FDC, mg.	Pre Exposure Hardness
79.822	79.74	79.74	76.5
High Conc. DC, cm2/sec	Low Conc. DC, cm2/sec	Total Liquid Sorbed, mg.	Post Desorption Hardness
1.6572E-07	5.7604E-11	1.878	75.1
R Square	R Square		Change in Hardness, %
0.99504	0.85851		-1.8
X Intercept	X Intercept		
96.72	509.6		Mean Thickness, cm.
Y Intercept	Y Intercept		0.0885
1.00383	0.09862		
			pc0082d
Y Intercept as Wt., mg.	X Intercept as Time, hrs.	X Intercept as Time, min.	X Intercept as Time, days
82.013	72.2	432.9	3.0
		Max. TGA Wt., (orig data file)	TGA Wt. At 20 min. Adjustment
		81.296	81.004

TEMPERATURE STATISTICS

Column1	
Mean	29.9997751
Standard Error	0.000349877
Median	30
Mode	30.001
Standard Deviation	0.022304498
Sample Variance	0.000497491
Kurtosis	1237.843422
Skewness	-29.75049737
Range	1.222
Minimum	28.983
Maximum	30.205
Sum	121919.086
Count	4064
Confidence Level(95.0%)	0.000685951

Sorption @ 7-12 min., mg	Sorption @ 20 min., mg
1.47	1.18
Sorption @ 7-12 min., %	Sorption @ 20 min., %
1.85	1.48
Rel. Error (%) of 7-12 min. Sorp.	Rel. Error (%) of 20 min. Sorp
-21.5	-37.1

HIGH CONCENTRATION DIFFUSION COEFFICIENT

pc0082d

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.997515832
R Square	0.995037835
Adjusted R Square	0.994822089
Standard Error	0.005089135
Observations	25

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.119449449	0.119449449	4612.07371	5.21878E-28
Residual	23	0.000595684	2.58993E-05		
Total	24	0.120045133			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	1.00383392	0.004326717	232.0082228	2.935E-40	0.994883437	1.012784404
X Variable 1	-0.010378585	0.000152823	-67.91225005	5.2188E-28	-0.010694724	-0.010062446

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.92655813
R Square	0.858509968
Adjusted R Square	0.858383975
Standard Error	0.005271814
Observations	1125

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.18937359	0.18937359	6813.95486	0
Residual	1123	0.031210442	2.7792E-05		
Total	1124	0.220584032			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.098615531	0.001046021	94.27682236	0	0.096563154	0.100667908
X Variable 1	-0.000193497	2.34409E-06	-82.54668293	0	-0.000198096	-0.000188898

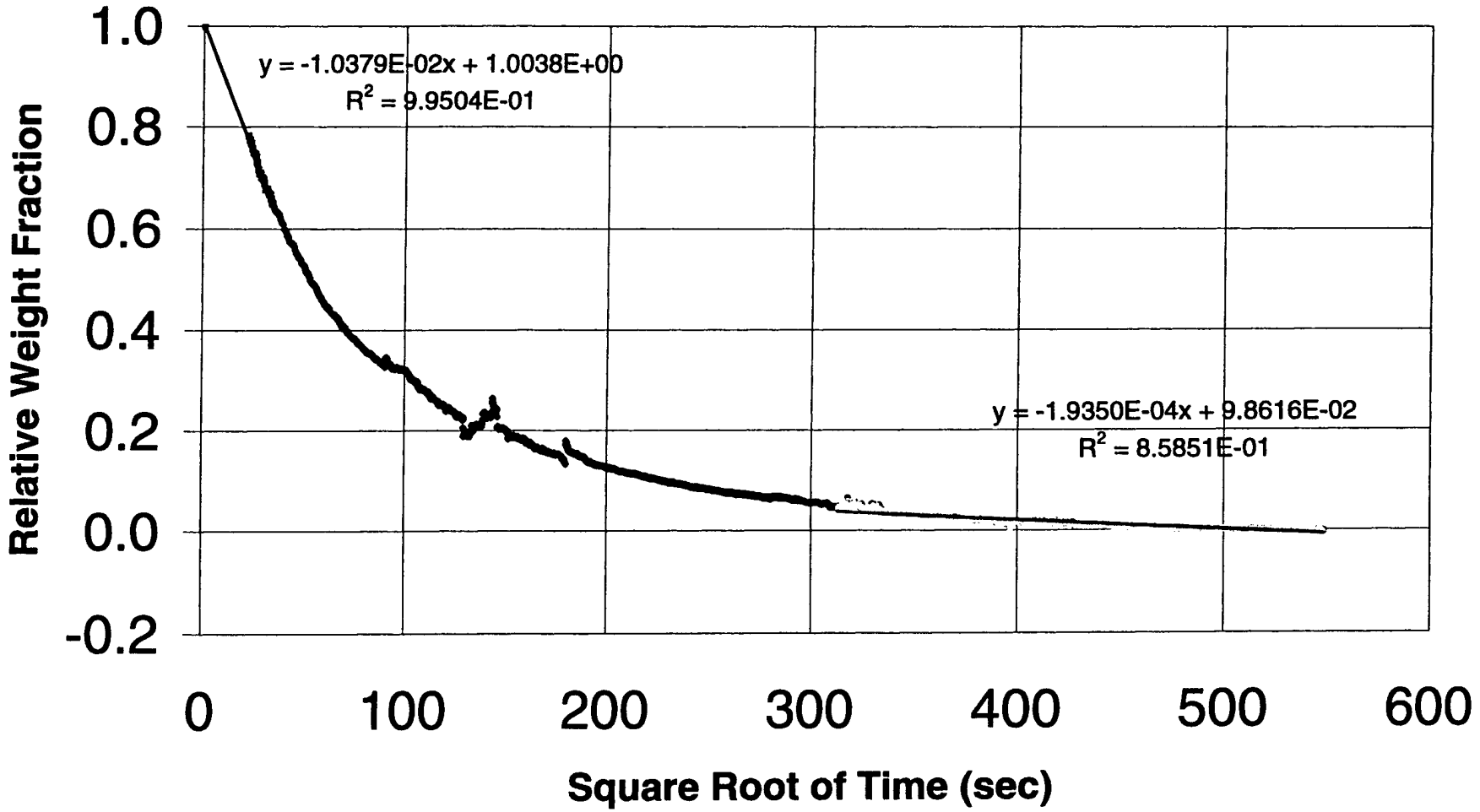
DIAMETER STATISTICS

	Column1	
	Mean	10.1175
	Standard Error	0.04130678
	Median	10.125
	Mode	#N/A
	Standard Deviation	0.08261356
	Sample Variance	0.006825
	Kurtosis	-3.032967
	Skewness	-0.3232314
	Range	0.18
	Minimum	10.02
	Maximum	10.2
ND/value	Sum	40.47
ND/value	Count	4
A/D	Confidence Level(95.0%)	0.13145673

THICKNESS STATISTICS

	Column1	
	Mean	34.85
	Standard Error	0.12583057
	Median	34.8
	Mode	34.8
	Standard Deviation	0.25166115
	Sample Variance	0.06333333
	Kurtosis	2.22714681
(LBR567)	Skewness	1.12933811
pc0082d	Range	0.6
	Minimum	34.6
	Maximum	35.2
	Sum	139.4
	Count	4
	Confidence Level(95.0%)	0.40044942

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PC (0082d)



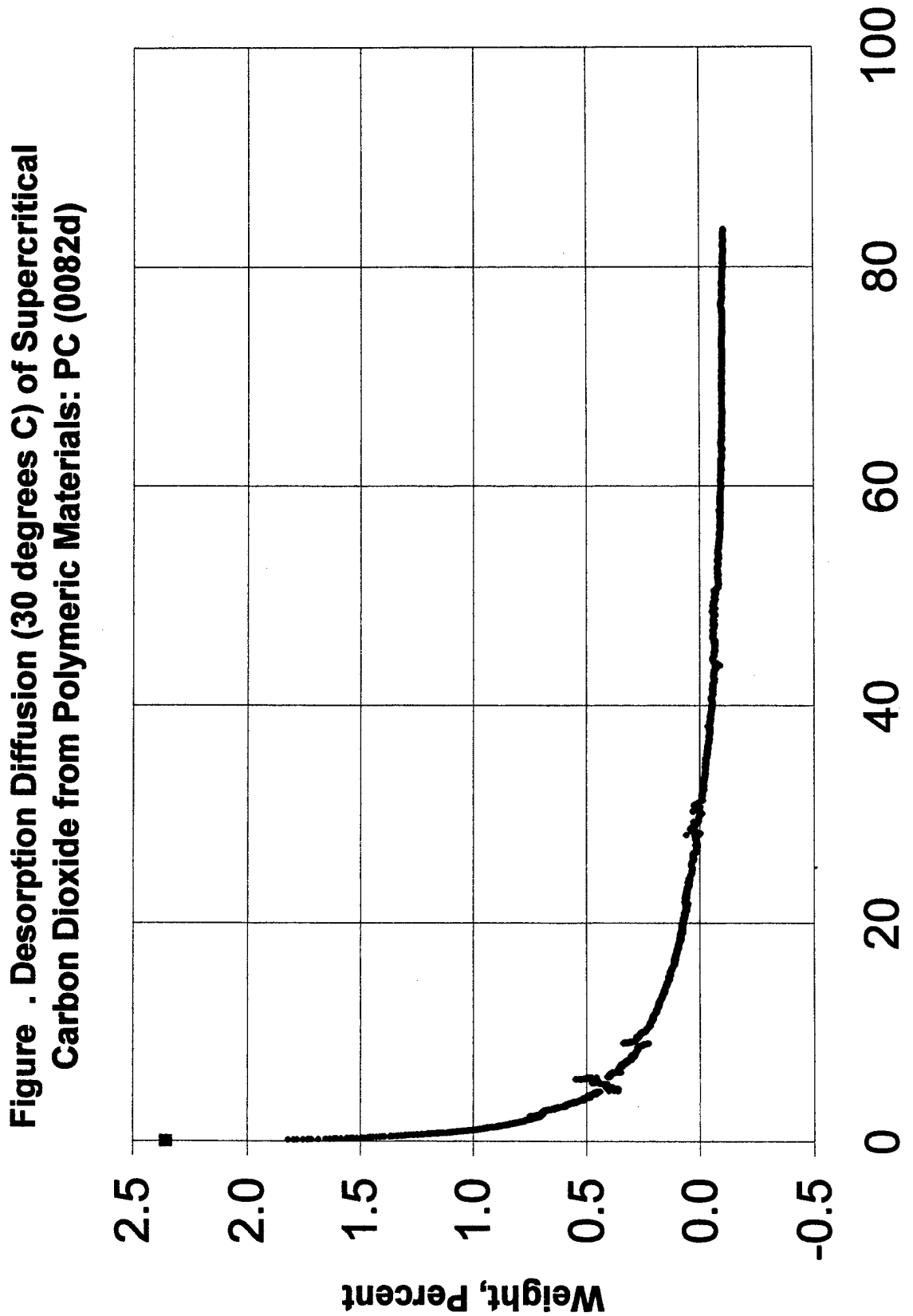


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PC (0082d)

Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PC (0082d)

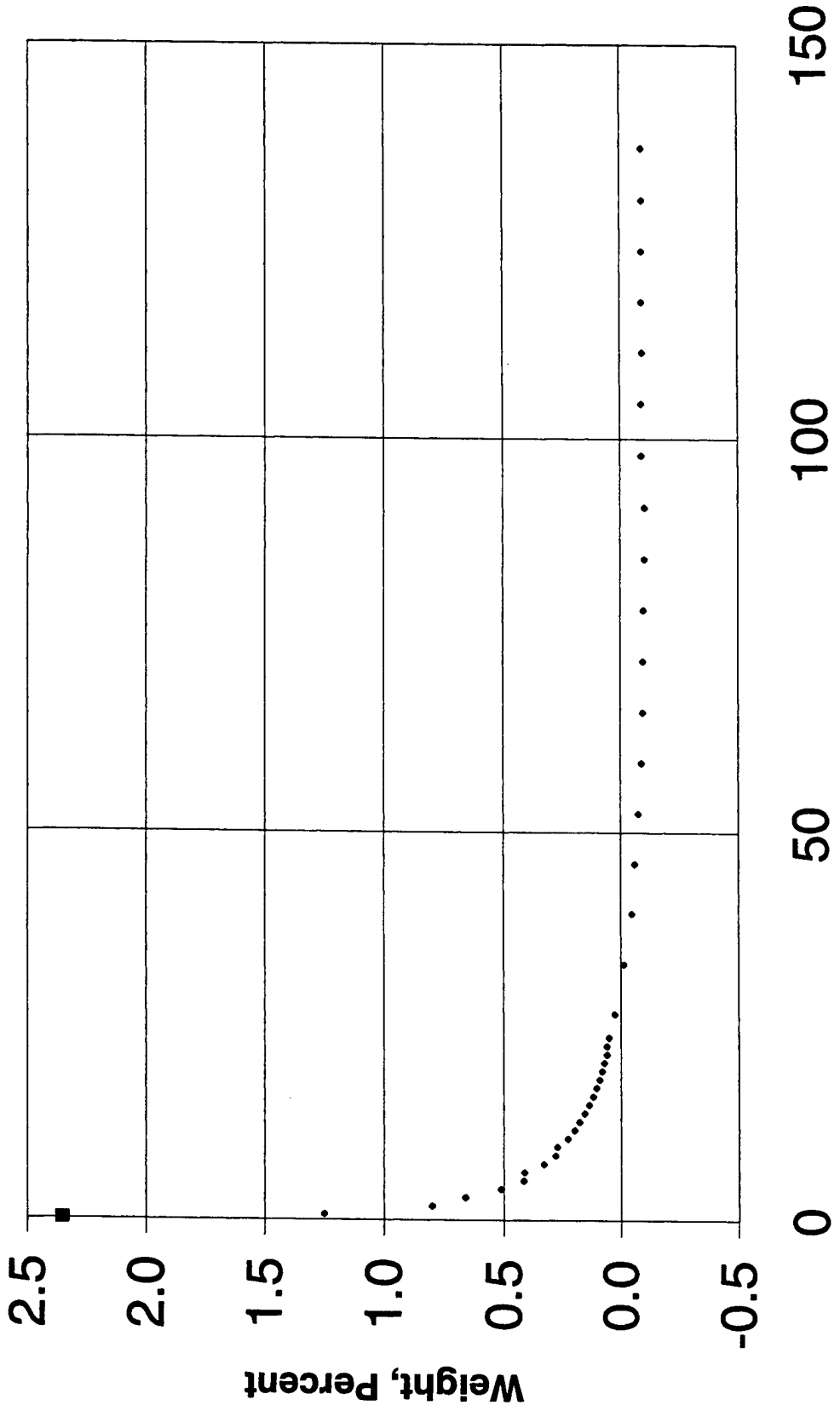
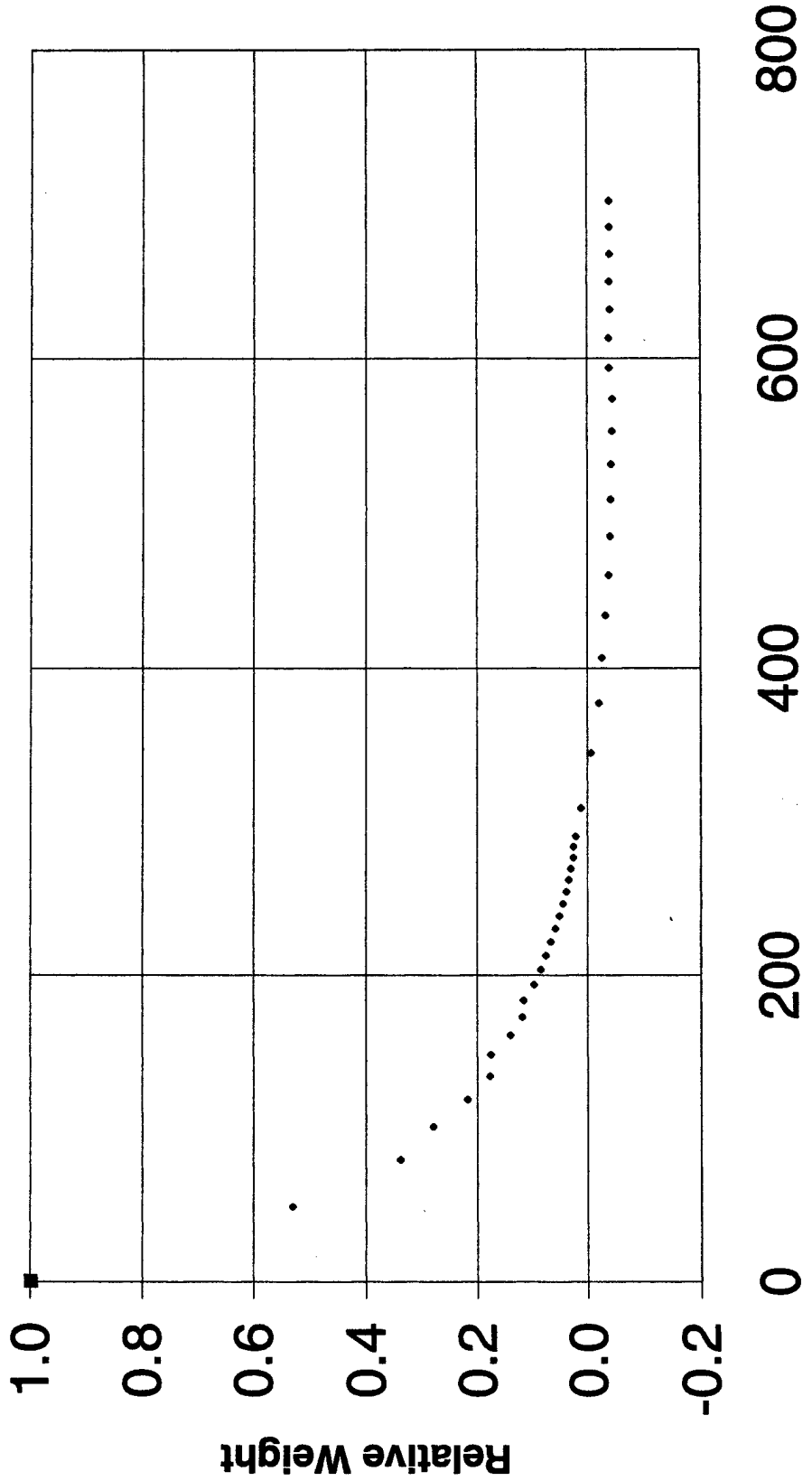


Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PC (0082d)



TGA Time, min	Temp., deg C	TGA Wt., mg	TGA Time, sec	Adjusted Time, sec	Adjusted Time, hr	SQRT Adj. Time, sec	Wt. Loss, %	Fractional Wt. Loss	Wt. @ Zero Time, mg	Wt. @ Zero Time, %	TGA Dry Wt., mg	Adjustment to TGA Time, sec	Hardness Scale
A	B	C	D	E	F	G	H	I	J	K	L	M	N
32.417	29.990	80.818	1945.020	2425.020	0.674	49.24	1.247	0.530	81.70	2.353	79.822	480	Shore D
97.464	30.000	80.458	5847.840	6327.840	1.758	79.55	0.797	0.339					
162.591	29.999	80.348	9755.460	10235.460	2.843	101.17	0.659	0.280					Pre Exposure
227.651	30.000	80.231	13659.060	14139.060	3.928	118.91	0.512	0.218	Formulae Used for Analysis of Data				Hardness
292.753	30.000	80.155	17565.180	18045.180	5.013	134.33	0.417	0.177	Uppercase letters refer to columns				76.5
357.780	30.000	80.152	21466.800	21946.800	6.096	148.14	0.413	0.176	Lowercase n refers to row, beginning with n=4				
422.833	30.000	80.086	25369.980	25849.980	7.181	160.78	0.331	0.141	----------				Post Desorption
487.904	30.000	80.046	29274.240	29754.240	8.265	172.49	0.281	0.119	Dn = (An * 60)				Hardness
552.997	30.000	80.041	33179.820	33659.820	9.350	183.47	0.275	0.117	En = (Dn + M4)				75.1
618.075	30.000	80.005	37084.500	37564.500	10.435	193.82	0.229	0.097	Fn = (En / 3600)				
683.164	30.000	79.983	40989.840	41469.840	11.519	203.64	0.201	0.086	Gn = SQRT (En)				Change in
748.254	30.000	79.965	44895.240	45375.240	12.604	213.01	0.179	0.076	Hn = (((Cn - L4) / L4) * 100)				Hardness, %
813.370	30.000	79.948	48802.200	49282.200	13.690	222.00	0.157	0.067	In = ((Cn - L4) / (J4 - L4))				-1.83
878.426	30.000	79.932	52705.560	53185.560	14.774	230.62	0.138	0.059	K4 = (((J4 - L4) / L4) * 100)				
943.478	30.000	79.919	56608.680	57088.680	15.858	238.93	0.121	0.051	N16 = (((N12 - N8) / N8) * 100)				
1008.549	30.000	79.907	60512.940	60992.940	16.942	246.97	0.106	0.045					
1073.637	30.000	79.896	64418.220	64898.220	18.027	254.75	0.092	0.039					
1138.696	30.000	79.887	68321.760	68801.760	19.112	262.30	0.081	0.034	Source binary TA data file : pc0082d.01				
1203.781	30.000	79.880	72226.860	72706.860	20.196	269.64	0.072	0.031	14 lines in the parameter block				
1268.901	30.000	79.871	76134.060	76614.060	21.282	276.79	0.061	0.026	3 channels of data				
1334.035	30.000	79.871	80042.100	80522.100	22.367	283.76	0.061	0.026	----------				
1399.086	30.000	79.863	83945.160	84425.160	23.451	290.56	0.051	0.022	Run 22				
1581.849	30.000	79.844	94910.940	95390.940	26.497	308.85	0.028	0.012	Module TGA Aluminum Pans				
1968.266	30.000	79.810	118095.960	118575.960	32.938	344.35	-0.015	-0.006	Sample PC SCCO2 0082D				
2358.268	30.000	79.783	141496.080	141976.080	39.438	376.80	-0.049	-0.021	Size 81.296 mg				
2748.295	30.000	79.773	164897.700	165377.700	45.938	406.67	-0.061	-0.026	Method DESORPTION-Isothermal				
3138.293	30.000	79.761	188297.580	188777.580	52.438	434.49	-0.077	-0.033	Operator WJS				
3528.291	30.000	79.750	211697.460	212177.460	58.938	460.63	-0.091	-0.038	Comment Disk: .4x0.03 in. HP@1400x50 Dry Wt, TGA: 79.822 ET: 7:45				
3918.331	30.000	79.745	235099.860	235579.860	65.439	485.37	-0.096	-0.041	Nsig 3				
4308.336	30.000	79.744	258500.160	258980.160	71.939	508.90	-0.098	-0.042	Sig1 Time (min)				
4698.346	30.000	79.742	281900.760	282380.760	78.439	531.40	-0.100	-0.042	Sig2 Temperature (øC)				
5088.349	30.000	79.738	305300.940	305780.940	84.939	552.97	-0.105	-0.045	Sig3 Weight (mg)				
5478.365	30.000	79.738	328701.900	329181.900	91.439	573.74	-0.106	-0.045	Kcell 1.0000				
5868.358	30.000	79.749	352101.480	352581.480	97.939	593.79	-0.092	-0.039	Date 22-Mar-00				
6258.353	30.000	79.749	375501.180	375981.180	104.439	613.17	-0.092	-0.039	Time 11:56				
6648.397	30.000	79.745	398903.820	399383.820	110.940	631.97	-0.096	-0.041					
7038.406	30.000	79.747	422304.360	422784.360	117.440	650.22	-0.094	-0.040					
7428.414	30.000	79.747	445704.840	446184.840	123.940	667.97	-0.094	-0.040					
7818.418	30.000	79.746	469105.080	469585.080	130.440	685.26	-0.095	-0.040					
8208.434	30.000	79.747	492506.040	492986.040	136.941	702.13	-0.094	-0.040					

FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Polycarbonate PC

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	04-1-2	TGA Filename:	pc0117d
Property Test Specification:	ASTM D471/D543		
Material Name:	Polycarbonate	Material Code:	PC
Material Supplier:	Harbor City Plastics	Material Class:	TP
Monomer Source:	General Electric	Base Polymer (Lot. No.):	(LBR567)
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	2

Pre-Exposure Data

Measured Diameter (mm):	10.26	10.16	10.08	10.22	
Mean Diameter:	10.190		95% Confidence Level (CL):		0.125
Measured Thickness (mils):	36.60	37.60	36.20	36.10	
Mean Thickness:	36.625		95% Confidence Level (CL):		1.090
Initial Sample Weight (mg):	83.130				
Initial Durometer Hardness:	76.9	Scale: SHORE		D	

Sample Exposure Data

Exposure Date:	04/26/00	Time:	14:32:00
Removal Date:	04/26/00	Time:	14:47:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	85.20
Weight Gain (mg):	2.07	Percent Weight Gain:	2.49
Final Durometer Hardness After Desorption:	76.1	Percent Hardness Change:	-1.0

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.000	95% CL:	0.0006
Time Lapse Between Sample Exposure and Sample Desorption (sec):			505
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			83.020
Sample Extracted (mg):	0.11	Solubility Corrected for Extractables (mg):	2.18
Sample Extracted (%):	0.13	Solubility Corrected for Extractables (%):	2.62

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm2/sec):			2.1310E-07
Range Including 0,1 Intercept, Relative Weight Fraction:			1.00 - 0.62
Linear Range of Desorption, Relative Weight Fraction:			0.75 - 0.62
Slope:	-1.1199E-02	X-axis Intercept:	8.9294E+01
R Square:	0.99947	Y-axis Intercept:	9.9998E-01

Low Concentration Diffusion Coefficient (cm2/sec):			1.1518E-10
Linear Range of Desorption, Relative Weight Fraction:			0.05 - 0.00
Slope:	-2.6035E-04	X-axis Intercept:	4.5669E+02
R Square:	0.95361	Y-axis Intercept:	1.1890E-01

Wt. @ Zero Time, mg K 85.20	Wt. @ Zero Time, % L 2.490	Adjustment to TGA Time, sec M 505	Hardness Shore Scale N D
TGA Dry Wt., mg 83.130	Equil. Wt. Of Desorb. Sample 83.02	Min. Wt. Used For FDC, mg. 83.020	Pre Exposure Hardness 76.9
High Conc. DC, cm2/sec 2.1310E-07	Low Conc. DC, cm2/sec 1.1518E-10	Total Liquid Sorbed, mg. 2.070	Post Desorption Hardness 76.1
R Square 0.99947	R Square 0.95361		Change in Hardness, % -1.0
X Intercept 89.29	X Intercept 456.7		Mean Thickness, cm. 0.0930
Y Intercept 0.99998	Y Intercept 0.11890		**pc0117d**
Y Intercept as Wt., mg. 85.198	X Intercept as Time, hrs. 57.9	X Intercept as Time, min. 347.6	X Intercept as Time, days 2.4
		Max. TGA Wt., (orig data file) 84.665	TGA Wt. At 20 min. Adjustment 84.362
		Sorption @ 7-12 min., mg 1.54	Sorption @ 20 min., mg 1.23
		Sorption @ 7-12 min., % 1.85	Sorption @ 20 min., % 1.48
		Rel. Error (%) of 7-12 min. Sorp. -25.8	Rel. Error (%) of 20 min. Sorp -40.5

TEMPERATURE STATISTICS

Column1	
Mean	30.00019721
Standard Error	0.000308961
Median	30
Mode	30
Standard Deviation	0.018874431
Sample Variance	0.000356244
Kurtosis	885.3566777
Skewness	-24.1727843
Range	0.952
Minimum	29.244
Maximum	30.196
Sum	111960.736
Count	3732
Confidence Level(95.0%)	0.000605747

HIGH CONCENTRATION DIFFUSION COEFFICIENT

pc0117d

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999735807
R Square	0.999471684
Adjusted R Square	0.999447669
Standard Error	0.001800319
Observations	24

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.134895688	0.134895688	41619.7136	1.50569E-37
Residual	22	7.13053E-05	3.24115E-06		
Total	23	0.134966994			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.999979835	0.001562048	640.1724278	1.7934E-48	0.996740343	1.003219327
X Variable 1	-0.011198696	5.48931E-05	-204.0091018	1.5057E-37	-0.011312537	-0.011084854

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.976527763
R Square	0.953606472
Adjusted R Square	0.953561254
Standard Error	0.003773243
Observations	1028

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.300253906	0.300253906	21089.1536	0
Residual	1026	0.014607533	1.42374E-05		
Total	1027	0.314861439			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.118901214	0.000694648	171.1674609	0	0.117538119	0.120264309
X Variable 1	-0.000260352	1.7928E-06	-145.221051	0	-0.00026387	-0.000256834

DIAMETER STATISTICS

Column1	
Mean	10.18
Standard Error	0.0391578
Median	10.19
Mode	#N/A
Standard Deviation	0.0783156
Sample Variance	0.00613333
Kurtosis	-0.768431
Skewness	-0.5995807
Range	0.18
Minimum	10.08
Maximum	10.26
Sum	40.72
Count	4
Confidence Level(95.0%)	0.12461771

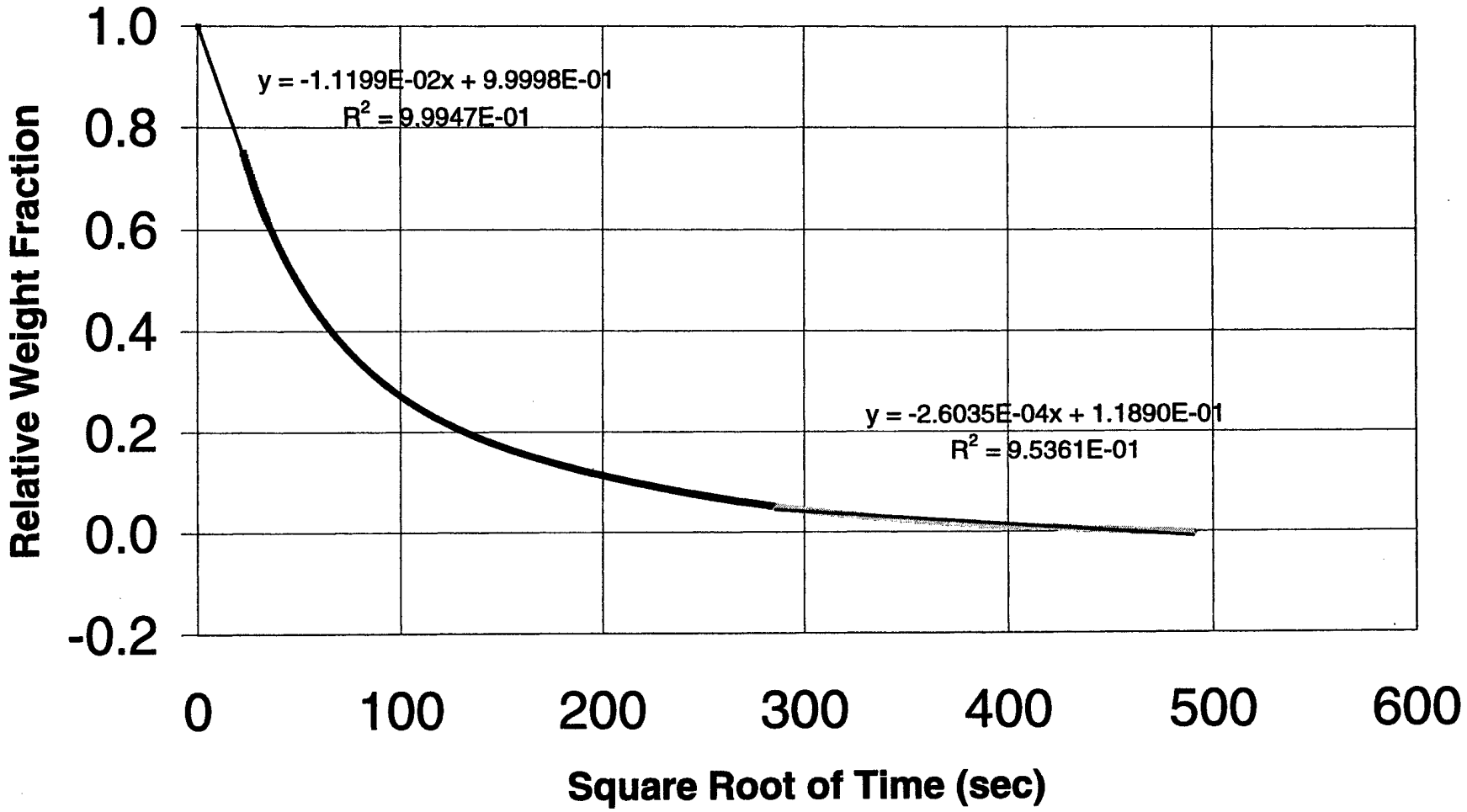
ND/value
ND/value
A/D

THICKNESS STATISTICS

Column1	
Mean	36.625
Standard Error	0.34247871
Median	36.4
Mode	#N/A
Standard Deviation	0.68495742
Sample Variance	0.46916667
Kurtosis	1.82944073
Skewness	1.46331586
Range	1.5
Minimum	36.1
Maximum	37.6
Sum	146.5
Count	4
Confidence Level(95.0%)	1.08992113

(LBR567)
pc0117d

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PC (0117d)



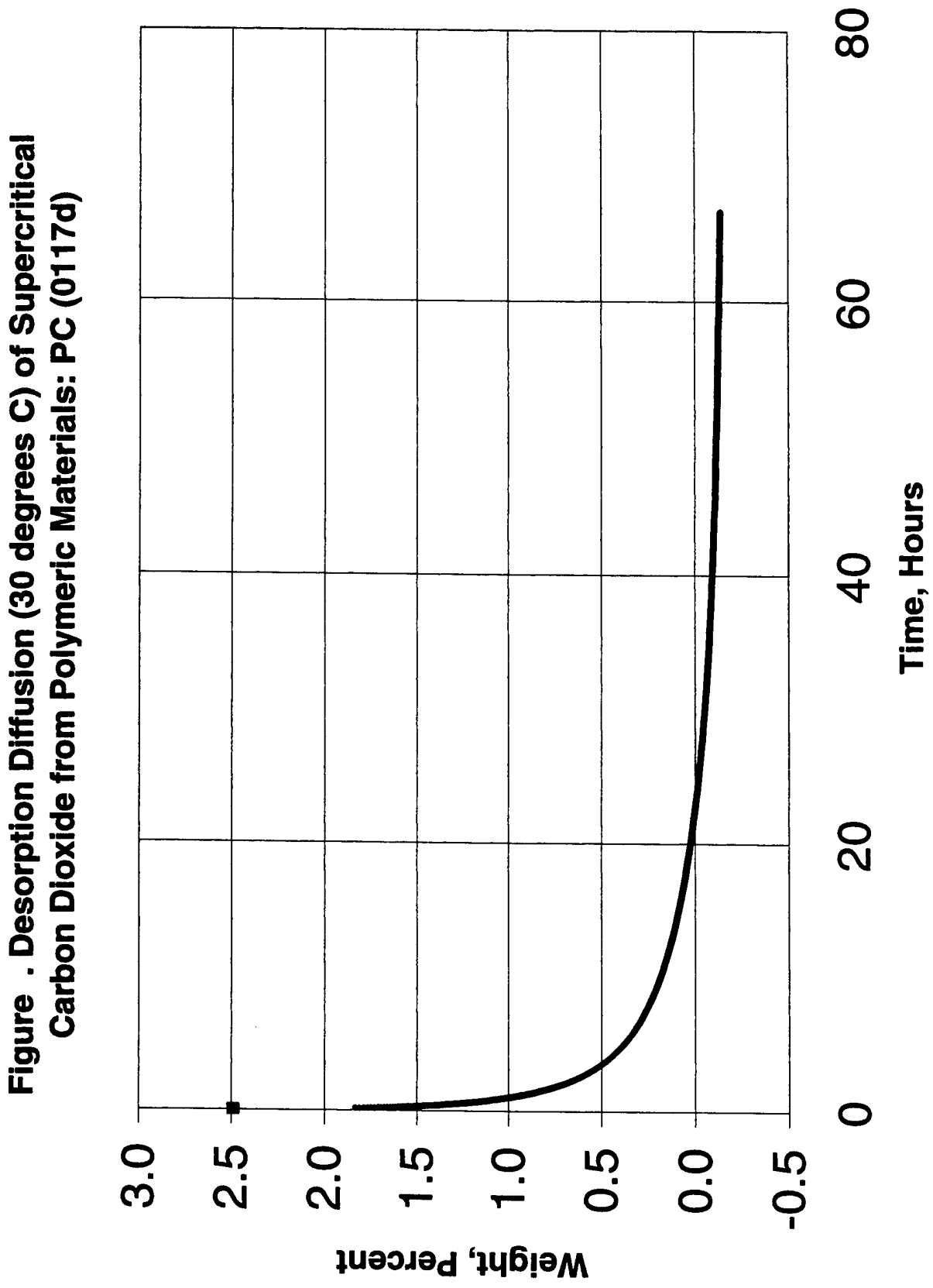


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PC (0117d)
Weight, Percent
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
0
20
40
60
80
Time, Hours

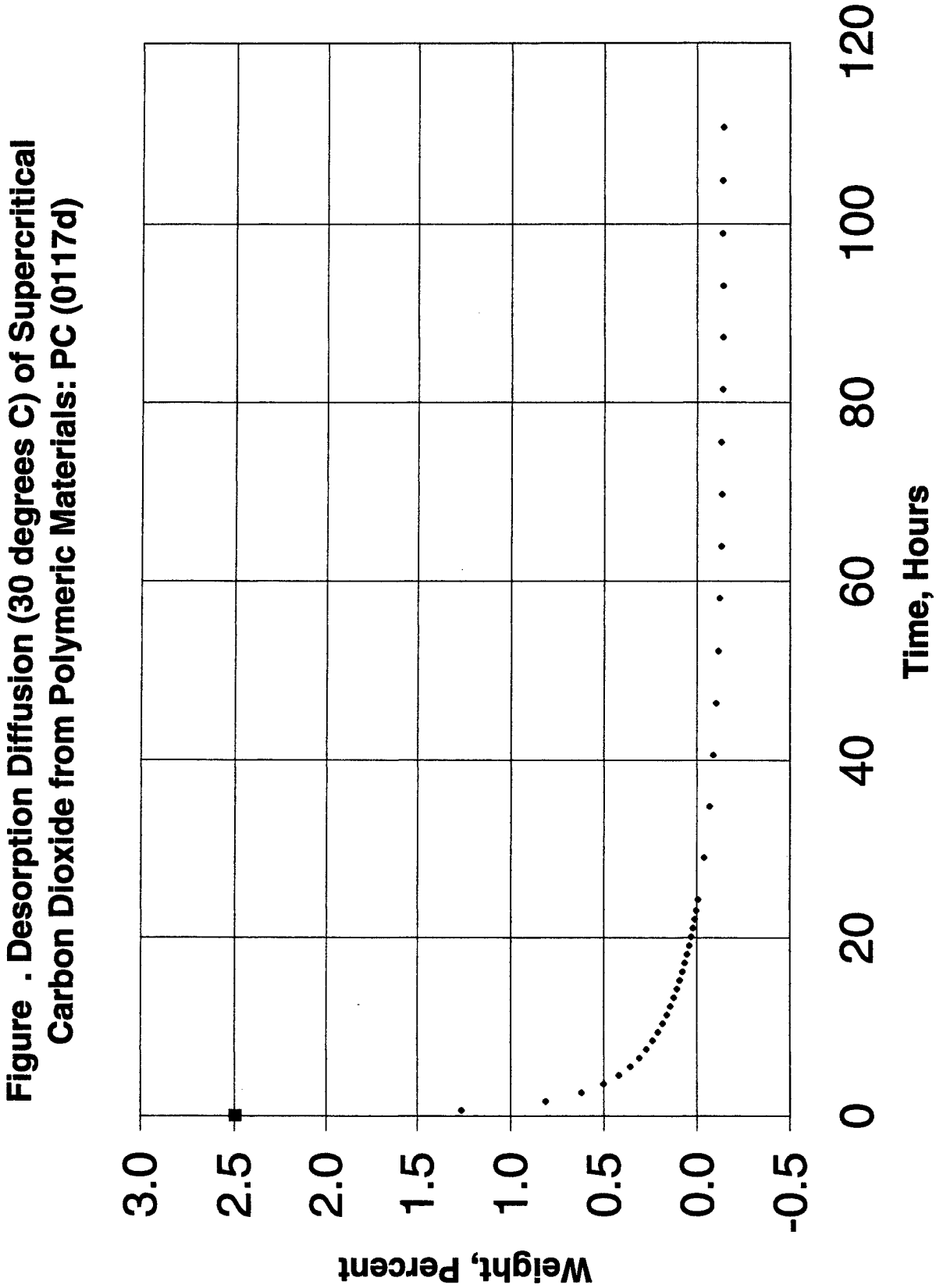


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PC (0117d)

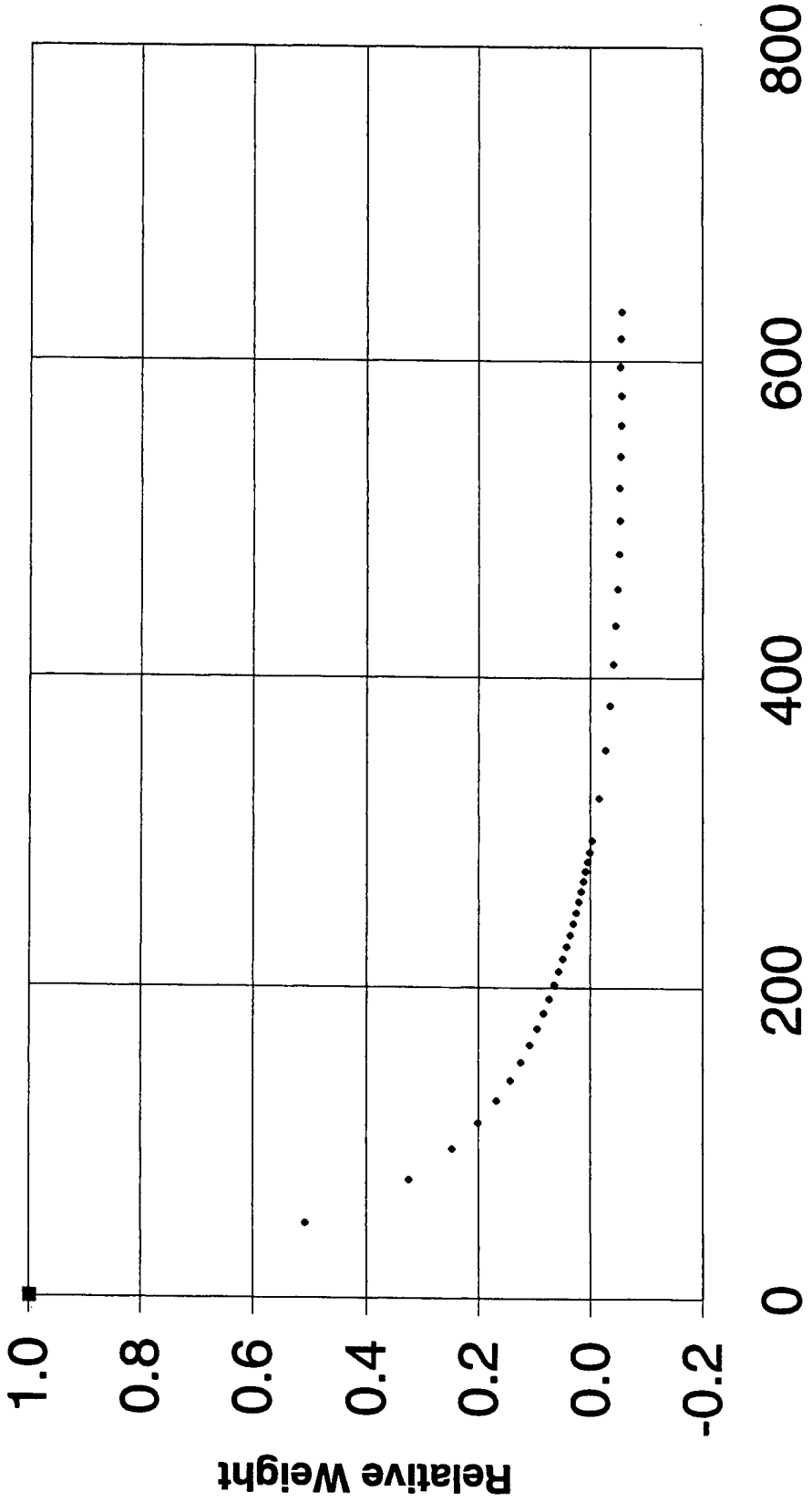


Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PC (0117d)

TGA Time, min	Temp., deg C	TGA Wt., mg	TGA Time, sec	Adjusted Time, sec	Adjusted Time, hr	SQRT Adj. Time, sec	Wt. Loss, %	Fractional Wt. Loss	Wt. @ Zero Time, mg	Wt. @ Zero Time, %	TGA Dry Wt., mg	Adjustment to TGA Time, sec	Hardness Scale
A	B	C	D	E	F	G	H	I	J	K	L	M	N
29.083	29.992	84.177	1744.980	2249.980	0.625	47.43	1.265	0.507	85.20	2.496	83.125	505	Shore D
87.426	30.001	83.800	5245.560	5750.560	1.597	75.83	0.812	0.325					
145.791	30.000	83.640	8747.460	9252.460	2.570	96.19	0.619	0.248					Pre Exposure
204.208	30.001	83.543	12252.480	12757.480	3.544	112.95	0.502	0.201	Formulae Used for Analysis of Data				Hardness
262.620	30.000	83.475	15757.200	16262.200	4.517	127.52	0.421	0.169	Uppercase letters refer to columns				76.9
321.006	30.000	83.424	19260.360	19765.360	5.490	140.59	0.360	0.144	Lowercase n refers to row, beginning with n=4				
379.389	30.000	83.384	22763.340	23268.340	6.463	152.54	0.312	0.125	----------				Post Desorption
437.756	30.000	83.352	26265.360	26770.360	7.436	163.62	0.273	0.109	Dn = (An * 60)				Hardness
496.161	30.000	83.324	29769.660	30274.660	8.410	174.00	0.240	0.096	En = (Dn + M4)				76.1
554.564	30.000	83.301	33273.840	33778.840	9.383	183.79	0.211	0.085	Fn = (En / 3600)				
613.002	30.000	83.279	36780.120	37285.120	10.357	193.09	0.186	0.074	Gn = SQRT (En)				Change in
671.416	30.000	83.261	40284.960	40789.960	11.331	201.97	0.163	0.065	Hn = (((Cn - L4) / L4) * 100)				Hardness, %
729.803	30.000	83.244	43788.180	44293.180	12.304	210.46	0.143	0.057	In = ((Cn - L4) / (J4 - L4))				-1.04
788.223	30.000	83.229	47293.380	47798.380	13.277	218.63	0.125	0.050	K4 = (((J4 - L4) / L4) * 100)				
846.650	30.000	83.215	50799.000	51304.000	14.251	226.50	0.108	0.043	N16 = (((N12 – N8) /N8) * 100)				
905.022	30.000	83.202	54301.320	54806.320	15.224	234.11	0.093	0.037					
963.398	30.001	83.190	57803.880	58308.880	16.197	241.47	0.079	0.031					
1021.827	30.000	83.179	61309.620	61814.620	17.171	248.63	0.065	0.026	Source binary TA data file : pc0117d.01				
1080.231	30.000	83.169	64813.860	65318.860	18.144	255.58	0.053	0.021	14 lines in the parameter block				
1138.601	30.000	83.160	68316.060	68821.060	19.117	262.34	0.042	0.017	3 channels of data				
1196.965	30.000	83.151	71817.900	72322.900	20.090	268.93	0.031	0.013	----------				
1255.317	30.000	83.143	75319.020	75824.020	21.062	275.36	0.022	0.009	Run 33				
1313.713	30.001	83.135	78822.780	79327.780	22.035	281.65	0.012	0.005	Module TGA Aluminum Pans				
1372.081	30.000	83.128	82324.860	82829.860	23.008	287.80	0.003	0.001	Sample PC SCCO2 0117D				
1445.169	30.000	83.119	86710.140	87215.140	24.226	295.32	-0.007	-0.003	Size 84.665 mg				
1727.199	30.000	83.093	103631.940	104136.940	28.927	322.70	-0.039	-0.015	Method DESORPTION-Isothermal				
2077.226	30.000	83.069	124633.560	125138.560	34.761	353.75	-0.068	-0.027	Operator BSI				
2427.234	30.000	83.052	145634.040	146139.040	40.594	382.28	-0.088	-0.035	Comment Disk: .4x0.03in., HP@1400x50, Dry: TG-83.125 M-82.96 ET: 8:15				
2777.250	30.000	83.040	166635.000	167140.000	46.428	408.83	-0.102	-0.041	Nsig 3				
3127.286	30.002	83.032	187637.160	188142.160	52.262	433.75	-0.112	-0.045	Sig1 Time (min)				
3477.314	30.002	83.024	208638.840	209143.840	58.096	457.32	-0.121	-0.049	Sig2 Temperature (øC)				
3827.326	30.002	83.018	229639.560	230144.560	63.929	479.73	-0.129	-0.052	Sig3 Weight (mg)				
4177.356	30.000	83.016	250641.360	251146.360	69.763	501.15	-0.132	-0.053	Kcell 1.0000				
4527.365	30.000	83.018	271641.900	272146.900	75.596	521.68	-0.129	-0.052	Date 26-Apr-00				
4877.375	30.003	83.012	292642.500	293147.500	81.430	541.43	-0.136	-0.055	Time 14:56				
5227.378	30.001	83.010	313642.680	314147.680	87.263	560.49	-0.139	-0.056					
5577.400	30.000	83.009	334644.000	335149.000	93.097	578.92	-0.139	-0.056					
5927.443	30.000	83.013	355646.580	356151.580	98.931	596.78	-0.135	-0.054					
6277.470	30.003	83.011	376648.200	377153.200	104.765	614.13	-0.138	-0.055					
6627.492	30.002	83.007	397649.520	398154.520	110.598	630.99	-0.142	-0.057					

Blank

FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Polymethyl Methacrylate PMMA

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	01-1-2	TGA Filename:	pmma105z
Property Test Specification:	ASTM D471/D543		
Material Name:	Polymethyl Methacrylate	Material Code:	PMMA
Material Supplier:	Harbor City Plastics	Material Class:	TP
Monomer Source:	Rohm & Haas	Base Polymer (Lot. No.):	Plexiglass (76B818)
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	2

Pre-Exposure Data

Measured Diameter (mm):		10.41	10.42	10.44	10.43	
Mean Diameter:	10.425			95% Confidence Level (CL):		0.021
Measured Thickness (mils):		38.30	39.40	39.40	39.00	
Mean Thickness:	39.025			95% Confidence Level (CL):		0.826
Initial Sample Weight (mg):		91.020				
Initial Durometer Hardness:		82.0	Scale: SHORE		D	

Sample Exposure Data

Exposure Date:	04/14/00	Time:	09:50:00
Removal Date:	04/14/00	Time:	10:05:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	96.70
Weight Gain (mg):	5.68	Percent Weight Gain:	6.24
Final Durometer Hardness After Desorption:	81.0	Percent Hardness Change:	-1.2

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.000	95% CL:	0.0006
Time Lapse Between Sample Exposure and Sample Desorption (sec):			480
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			91.220
Sample Extracted (mg): -0.20	Solubility Corrected for Extractables (mg):		5.68
Sample Extracted (%): -0.22	Solubility Corrected for Extractables (%):		6.24

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm^2/sec):			9.6726E-08
Range Including Intercept (0,1), Relative Weight Fraction:			1.00 - 0.70
Linear Range of Desorption, Relative Weight Fraction:			0.84 - 0.70
Slope:	-7.0808E-03	X-axis Intercept:	1.4056E+02
R Square:	0.99879	Y-axis Intercept:	9.9531E-01

Low Concentration Diffusion Coefficient (cm^2/sec):			1.6240E-10
Linear Range of Desorption, Relative Weight Fraction:			0.07 - 0.04
Slope:	-2.9014E-04	X-axis Intercept:	6.8436E+02
R Square:	0.98778	Y-axis Intercept:	1.9856E-01

Wt. @ Zero Time, mg	Wt. @ Zero Time, %	Adjustment to TGA Time, sec	Hardness Shore Scale
K	L	M	N
96.70	6.240	480	D
TGA Dry Wt., mg	Equil. Wt. Of Desorb. Sample	Min. Wt. Used For FDC, mg.	Pre Exposure Hardness
91.020	91.22	91.020	82.0
High Conc. DC, cm2/sec	Low Conc. DC, cm2/sec	Total Liquid Sorbed, mg.	Post Desorption Hardness
9.6726E-08	1.6240E-10	5.680	81.0
R Square	R Square		Change in Hardness, %
0.99879	0.98778		-1.2
X Intercept	X Intercept		
140.56	684.4		Mean Thickness, cm.
Y Intercept	Y Intercept		0.0991
0.99531	0.19856		
			pmma105z
Y Intercept as Wt., mg.	X Intercept as Time, hrs.	X Intercept as Time, min.	X Intercept as Time, days
96.246	130.1	780.6	5.4
		Max. TGA Wt., (orig data file)	TGA Wt. At 20 min. Adjustment
		95.811	95.271
		Sorption @ 7-12 min., mg	Sorption @ 20 min., mg
		4.79	4.25
		Sorption @ 7-12 min., %	Sorption @ 20 min., %
		5.26	4.67
		Rel. Error (%) of 7-12 min. Sorp.	Rel. Error (%) of 20 min. Sorp
		-15.7	-25.2

TEMPERATURE STATISTICS

Column1	
Mean	30.00010643
Standard Error	0.000290767
Median	30
Mode	29.999
Standard Deviation	0.018843886
Sample Variance	0.000355092
Kurtosis	633.726776
Skewness	-15.92093413
Range	0.948
Minimum	29.304
Maximum	30.252
Sum	126000.447
Count	4200
Confidence Level(95.0%)	0.000570058

HIGH CONCENTRATION DIFFUSION COEFFICIENT

pmma105z

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999392912
R Square	0.998786192
Adjusted R Square	0.998757963
Standard Error	0.001910724
Observations	45

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.129177474	0.129177474	35382.6889	2.46696E-64
Residual	43	0.000156987	3.65087E-06		
Total	44	0.129334462			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.995306197	0.001254388	793.4594157	3.3271E-91	0.992776484	0.99783591
X Variable 1	-0.007080764	3.7643E-05	-188.1028679	2.467E-64	-0.007156678	-0.00700485

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.993869749
R Square	0.987777077
Adjusted R Square	0.987758669
Standard Error	0.001092044
Observations	666

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.063992957	0.063992957	53660.1588	0
Residual	664	0.00079186	1.19256E-06		
Total	665	0.064784817			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.198557182	0.000644294	308.1780092	0	0.197292082	0.199822282
X Variable 1	-0.000290135	1.25249E-06	-231.6466247	0	-0.000292594	-0.000287676

DIAMETER STATISTICS

	Column1
Mean	10.425
Standard Error	0.00645497
Median	10.425
Mode	#N/A
Standard Deviation	0.01290994
Sample Variance	0.00016667
Kurtosis	-1.2
Skewness	4.1231E-13
Range	0.03
Minimum	10.41
Maximum	10.44
Sum	41.7
Count	4
Confidence Level(95.0%)	0.02054262

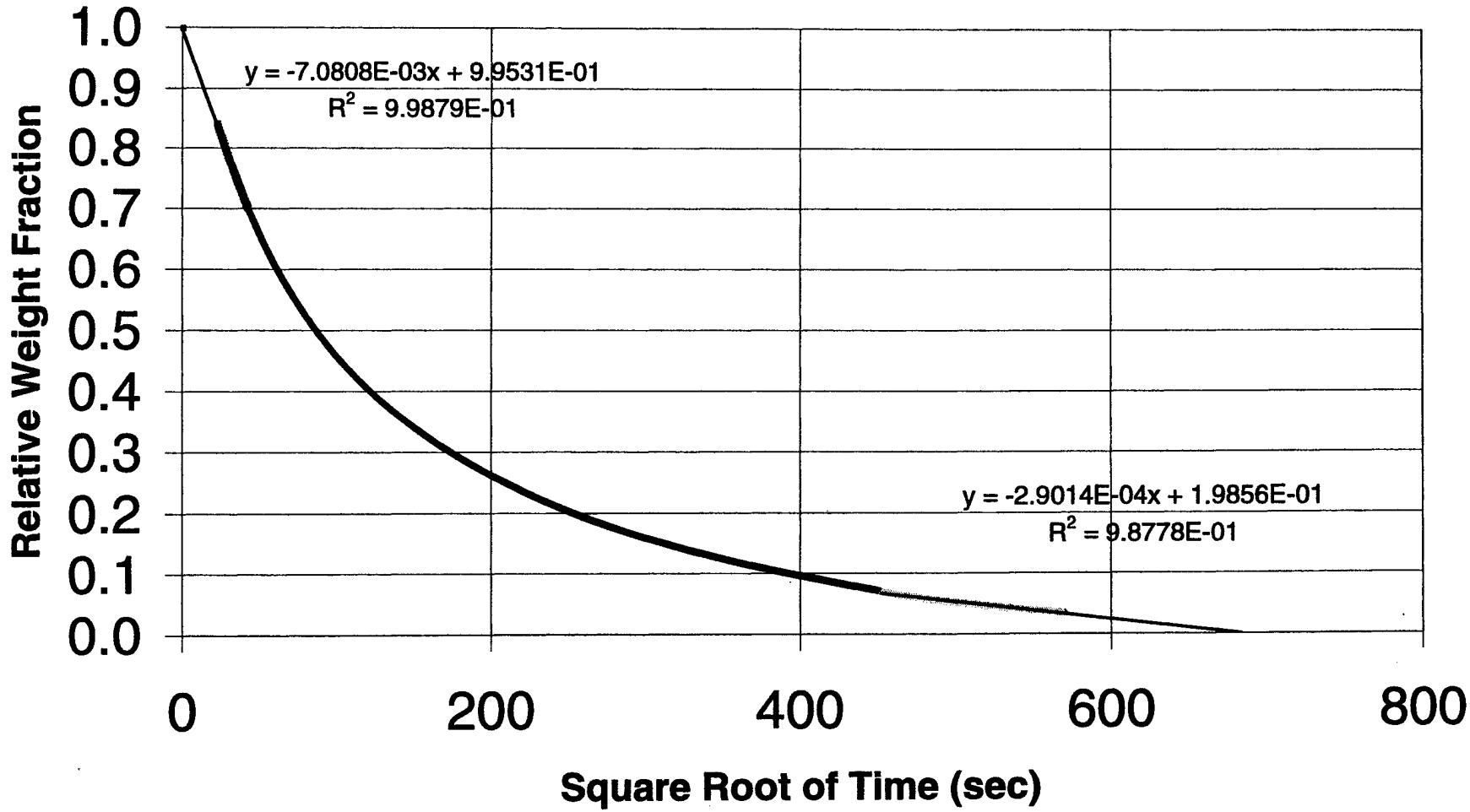
ND/value
ND/value
A/D

THICKNESS STATISTICS

	Column1
Mean	39.025
Standard Error	0.25940637
Median	39.2
Mode	39.4
Standard Deviation	0.51881275
Sample Variance	0.26916667
Kurtosis	1.030931
Skewness	-1.3158168
Range	1.1
Minimum	38.3
Maximum	39.4
Sum	156.1
Count	4
Confidence Level(95.0%)	0.82554763

Plexiglass (76B818)
pmma105z

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PMMA (105z)



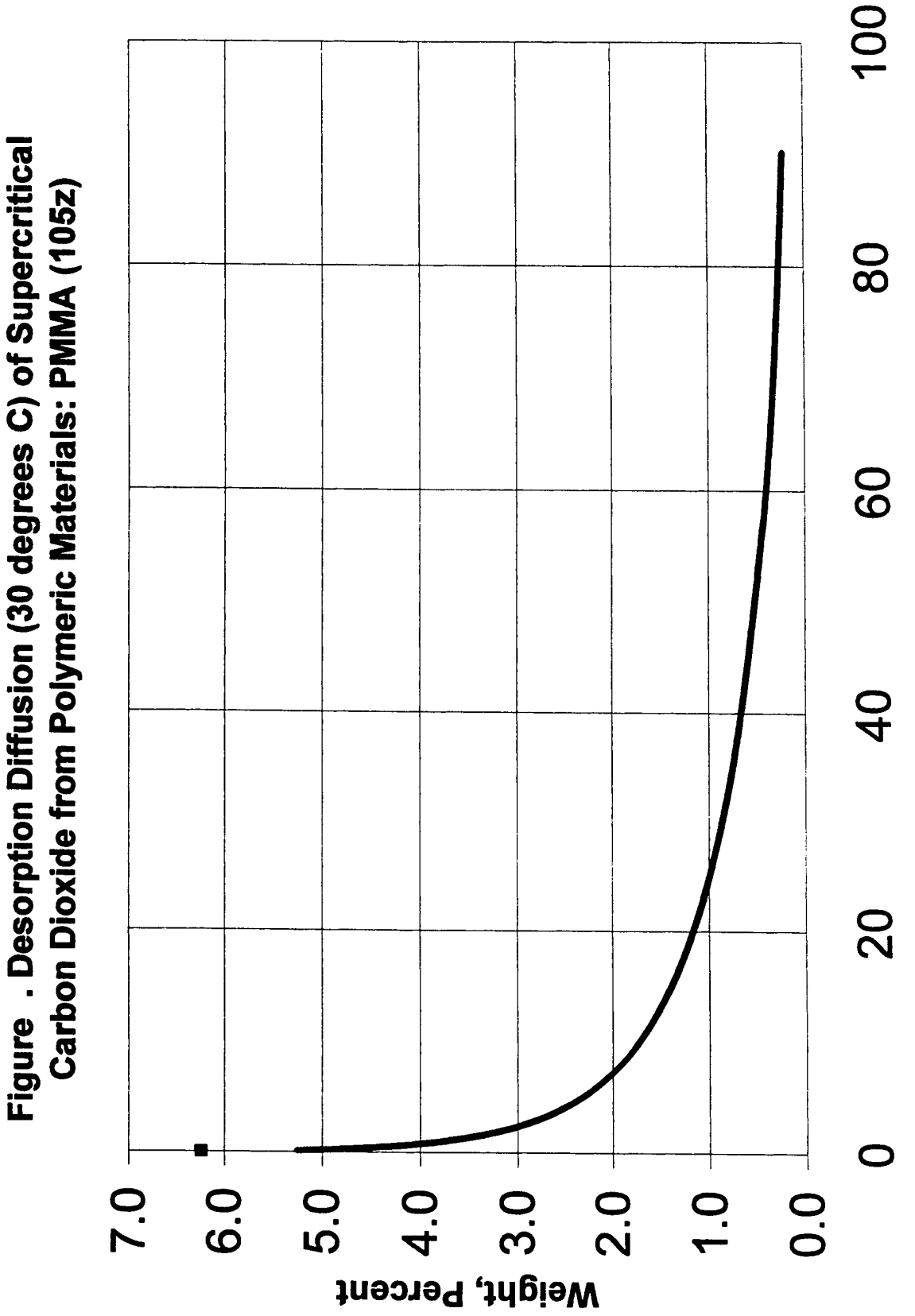


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PMMA (105z)

Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PMMA (105z)

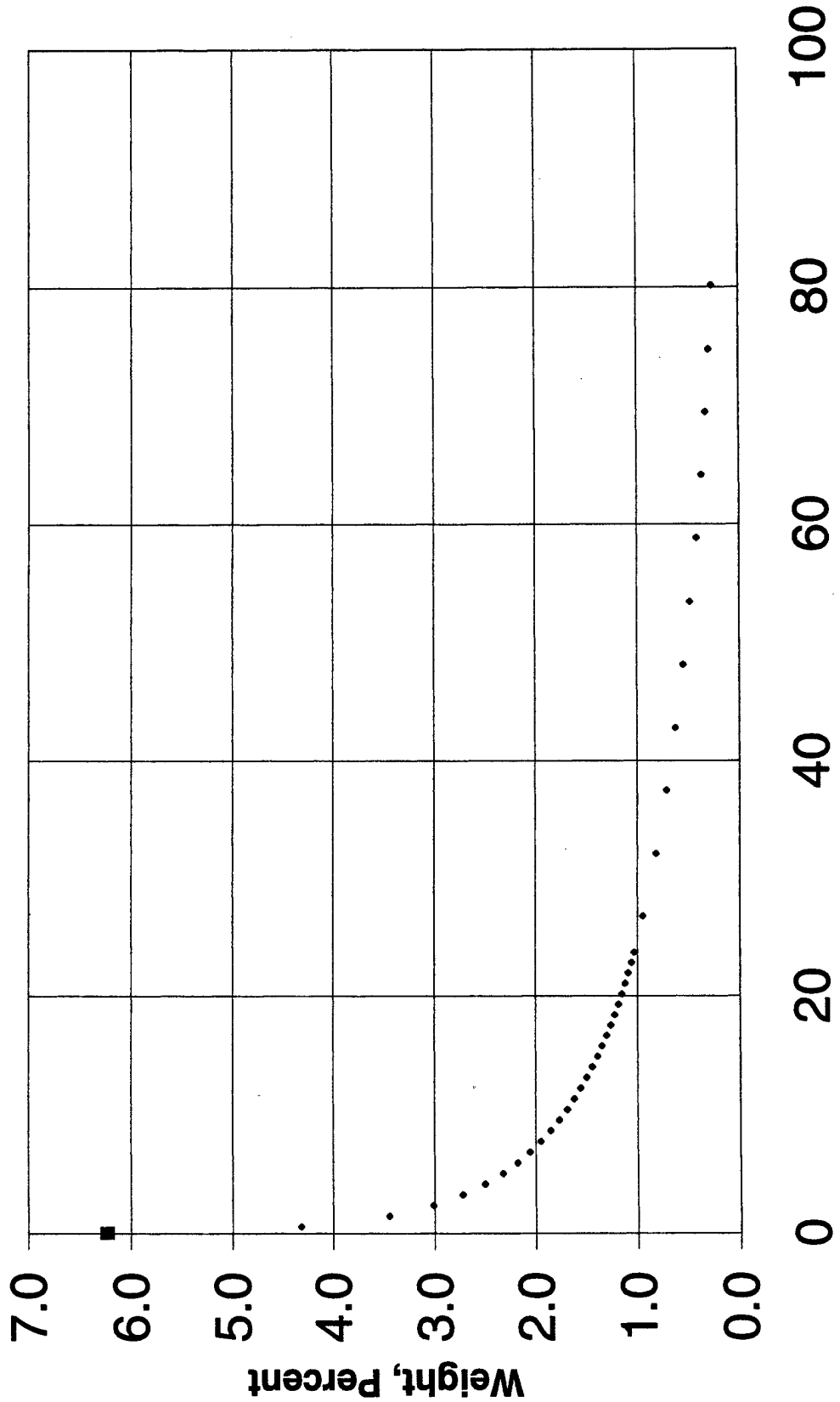
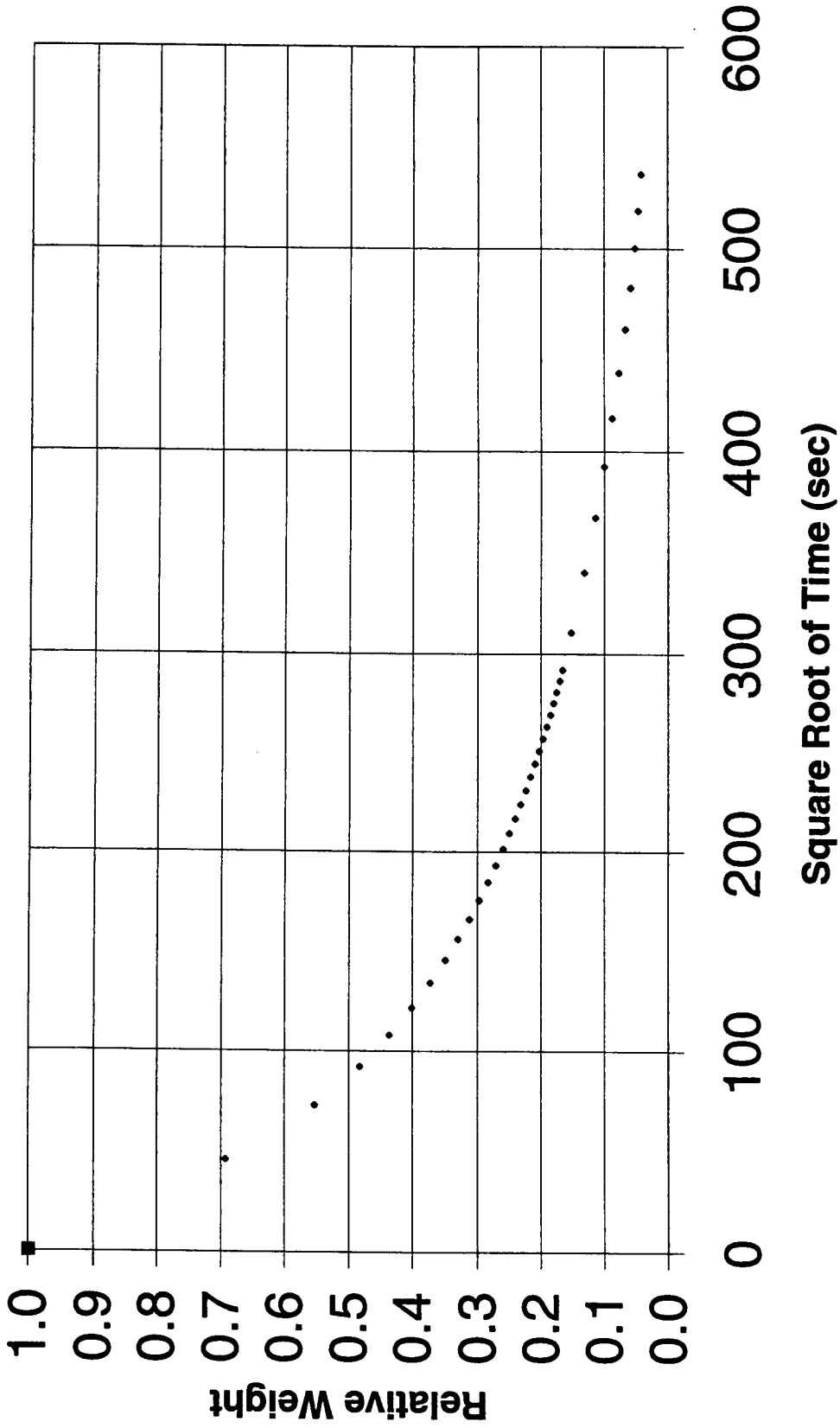


Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PMMA (105z)



TGA Time, min	Temp., deg C	TGA Wt., mg	TGA Time, sec	Adjusted Time, sec	Adjusted Time, hr	SQRT Adj. Time, sec	Wt. Loss, %	Fractional Wt. Loss	Wt. @ Zero Time, mg	Wt. @ Zero Time, %	TGA Dry Wt., mg	Adjustment to TGA Time, sec	Hardness Scale
A	B	C	D	E	F	G	H	I	J	K	L	M	N
26.605	29.999	94.957	1596.300	2076.300	0.577	45.57	4.323	0.693	96.70	6.238	91.022	480	Shore D
79.973	30.000	94.162	4798.380	5278.380	1.466	72.65	3.450	0.553					
133.333	30.000	93.765	7999.980	8479.980	2.356	92.09	3.014	0.483					Pre Exposure
186.679	30.000	93.499	11200.740	11680.740	3.245	108.08	2.721	0.436	Formulae Used for Analysis of Data				Hardness
240.073	30.000	93.298	14404.380	14884.380	4.135	122.00	2.501	0.401	Uppercase letters refer to columns				82.0
293.439	30.000	93.139	17606.340	18086.340	5.024	134.49	2.326	0.373	Lowercase n refers to row, beginning with n=4				
346.831	30.000	93.007	20809.860	21289.860	5.914	145.91	2.181	0.350	----------				Post Desorption
400.198	30.000	92.895	24011.880	24491.880	6.803	156.50	2.058	0.330	Dn = (An * 60)				Hardness
453.559	30.000	92.796	27213.540	27693.540	7.693	166.41	1.949	0.313	En = (Dn + M4)				81.0
506.906	30.000	92.709	30414.360	30894.360	8.582	175.77	1.853	0.297	Fn = (En / 3600)				
560.272	30.000	92.632	33616.320	34096.320	9.471	184.65	1.769	0.284	Gn = SQRT (En)				Change in
613.652	30.000	92.563	36819.120	37299.120	10.361	193.13	1.693	0.271	Hn = (((Cn - L4) / L4) * 100)				Hardness, %
667.059	30.000	92.499	40023.540	40503.540	11.251	201.25	1.623	0.260	In = ((Cn - L4) / (J4 - L4))				-1.22
720.461	30.000	92.442	43227.660	43707.660	12.141	209.06	1.560	0.250	K4 = (((J4 - L4) / L4) * 100)				
773.847	30.000	92.389	46430.820	46910.820	13.031	216.59	1.502	0.241	N16 = (((N12 – N8) /N8) * 100)				
827.254	30.000	92.339	49635.240	50115.240	13.921	223.86	1.447	0.232					
880.620	30.000	92.294	52837.200	53317.200	14.810	230.91	1.397	0.224					
933.985	30.000	92.251	56039.100	56519.100	15.700	237.74	1.350	0.216	Source binary TA data file : pmma105z.01				
987.347	30.000	92.211	59240.820	59720.820	16.589	244.38	1.306	0.209	14 lines in the parameter block				
1040.723	30.000	92.174	62443.380	62923.380	17.479	250.85	1.265	0.203	3 channels of data				
1094.104	30.000	92.139	65646.240	66126.240	18.368	257.15	1.228	0.197	----------				
1147.511	30.000	92.106	68850.660	69330.660	19.259	263.31	1.191	0.191	Run 28				
1200.894	30.000	92.075	72053.640	72533.640	20.148	269.32	1.157	0.185	Module TGA Aluminum Pans				
1254.264	30.000	92.045	75255.840	75735.840	21.038	275.20	1.124	0.180	Sample PMMA SCO2 PMMA105Z				
1307.687	30.000	92.017	78461.220	78941.220	21.928	280.96	1.093	0.175	Size 95.811 mg				
1361.055	30.000	91.989	81663.300	82143.300	22.818	286.61	1.063	0.170	Method DESORPTION-Isothermal				
1414.413	30.000	91.964	84864.780	85344.780	23.707	292.14	1.035	0.166	Operator WJS				
1601.095	30.000	91.885	96065.700	96545.700	26.818	310.72	0.948	0.152	Comment Disk: .4x0.03 in. HP@1400x50, DRY: TG: 91.022, M: 91.20 ET:8.00				
1921.123	30.000	91.767	115267.380	115747.380	32.152	340.22	0.818	0.131	Nsig 3				
2241.156	30.000	91.670	134469.360	134949.360	37.486	367.35	0.711	0.114	Sig1 Time (min)				
2561.181	30.000	91.589	153670.860	154150.860	42.820	392.62	0.623	0.100	Sig2 Temperature (øC)				
2881.187	30.000	91.521	172871.220	173351.220	48.153	416.35	0.548	0.088	Sig3 Weight (mg)				
3201.232	30.000	91.459	192073.920	192553.920	53.487	438.81	0.480	0.077	Kcell 1.0000				
3521.241	30.000	91.400	211274.460	211754.460	58.821	460.17	0.416	0.067	Date 14-Apr-00				
3841.253	30.000	91.354	230475.180	230955.180	64.154	480.58	0.365	0.058	Time 10:13				
4161.287	30.000	91.317	249677.220	250157.220	69.488	500.16	0.324	0.052					
4481.306	30.000	91.287	268878.360	269358.360	74.822	519.00	0.291	0.047					
4801.333	30.000	91.261	288079.980	288559.980	80.156	537.18	0.263	0.042					

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FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Polymethyl Methacrylate PMMA

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	01-1-1	TGA Filename:	pmma075z
Property Test Specification:	ASTM D471/D543		
Material Name:	Polymethyl Methacrylate	Material Code:	PMMA
Material Supplier:	Harbor City Plastics	Material Class:	TP
Monomer Source:	Rohm & Haas	Base Polymer (Lot. No.):	Plexiglass (76B818)
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	1

Pre-Exposure Data

Measured Diameter (mm):		10.41	10.32	10.29	10.30	
Mean Diameter:	10.330			95% Confidence Level (CL):		0.087
Measured Thickness (mils):		38.30	38.90	38.20	38.20	
Mean Thickness:	38.400			95% Confidence Level (CL):		0.536
Initial Sample Weight (mg):		90.900				
Initial Durometer Hardness:		80.2	Scale: SHORE		D	

Sample Exposure Data

Exposure Date:	03/15/00	Time:	11:12:00
Removal Date:	03/15/00	Time:	11:27:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	96.20
Weight Gain (mg):	5.30	Percent Weight Gain:	5.83
Final Durometer Hardness After Desorption:	79.5	Percent Hardness Change:	-0.9

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.000	95% CL:	0.0012
Time Lapse Between Sample Exposure and Sample Desorption (sec):			480
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			91.720
Sample Extracted (mg):	-0.82	Solubility Corrected for Extractables (mg):	5.30
Sample Extracted (%):	-0.90	Solubility Corrected for Extractables (%):	5.83

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm^2/sec):			9.5093E-08
Range Including Intercept (0,1), Relative Weight Fraction:			1.00 - 0.70
Linear Range of Desorption, Relative Weight Fraction:			0.84 - 0.70
Slope:	-7.1350E-03	X-axis Intercept:	1.3810E+02
R Square:	0.99602	Y-axis Intercept:	9.8532E-01

Low Concentration Diffusion Coefficient (cm^2/sec):			1.8087E-09
Linear Range of Desorption, Relative Weight Fraction:			0.20 - 0.15
Slope:	-9.8402E-04	X-axis Intercept:	4.4025E+02
R Square:	0.99931	Y-axis Intercept:	4.3322E-01

Wt. @ Zero Time, mg K 96.20	Wt. @ Zero Time, % L 5.831	Adjustment to TGA Time, sec M 480	Hardness Shore Scale N D
TGA Dry Wt., mg 90.90	Equil. Wt. Of Desorb. Sample 91.72	Min. Wt. Used For FDC, mg. 90.90	Pre Exposure Hardness 80.2
High Conc. DC, cm2/sec 9.5093E-08	Low Conc. DC, cm2/sec 1.8087E-09	Total Liquid Sorbed, mg. 5.300	Post Desorption Hardness 79.5
R Square 0.99602	R Square 0.99931		Change in Hardness, % -0.9
X Intercept 138.10	X Intercept 440.3		Mean Thickness, cm. 0.0975
Y Intercept 0.98532	Y Intercept 0.43322		**pmma075z**
Y Intercept as Wt., mg. 94.788	X Intercept as Time, hrs. 53.8	X Intercept as Time, min. 323.0	X Intercept as Time, days 2.2
		Max. TGA Wt., (orig data file) 95.283	TGA Wt. At 20 min. Adjustment 94.810
		Sorption @ 7-12 min., mg 4.38	Sorption @ 20 min., mg 3.91
		Sorption @ 7-12 min., % 4.82	Sorption @ 20 min., % 4.30
		Rel. Error (%) of 7-12 min. Sorp. -17.3	Rel. Error (%) of 20 min. Sorp -26.2

TEMPERATURE STATISTICS

Column1	
Mean	30.00002503
Standard Error	0.000611564
Median	30
Mode	30
Standard Deviation	0.031642147
Sample Variance	0.001001225
Kurtosis	388.3126273
Skewness	-12.72037019
Range	1.251
Minimum	29.078
Maximum	30.329
Sum	80310.067
Count	2677
Confidence Level(95.0%)	0.001199186

HIGH CONCENTRATION DIFFUSION COEFFICIENT

pmma075z

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.998007353
R Square	0.996018676
Adjusted R Square	0.995916591
Standard Error	0.003392701
Observations	41

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.112304144	0.112304144	9756.73689	2.01829E-48
Residual	39	0.000448906	1.15104E-05		
Total	40	0.11275305			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.985321378	0.002340215	421.0388357	6.0118E-73	0.980587851	0.990054905
X Variable 1	-0.007135014	7.22341E-05	-98.77619599	2.0183E-48	-0.007281121	-0.006988907

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999653993
R Square	0.999308105
Adjusted R Square	0.999307256
Standard Error	0.000351402
Observations	817

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.145353831	0.145353831	1177109.34	0
Residual	815	0.000100639	1.23484E-07		
Total	816	0.14545447			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.433216228	0.000237547	1823.708373	0	0.432749951	0.433682504
X Variable 1	-0.000984018	9.06974E-07	-1084.946701	0	-0.000985798	-0.000982238

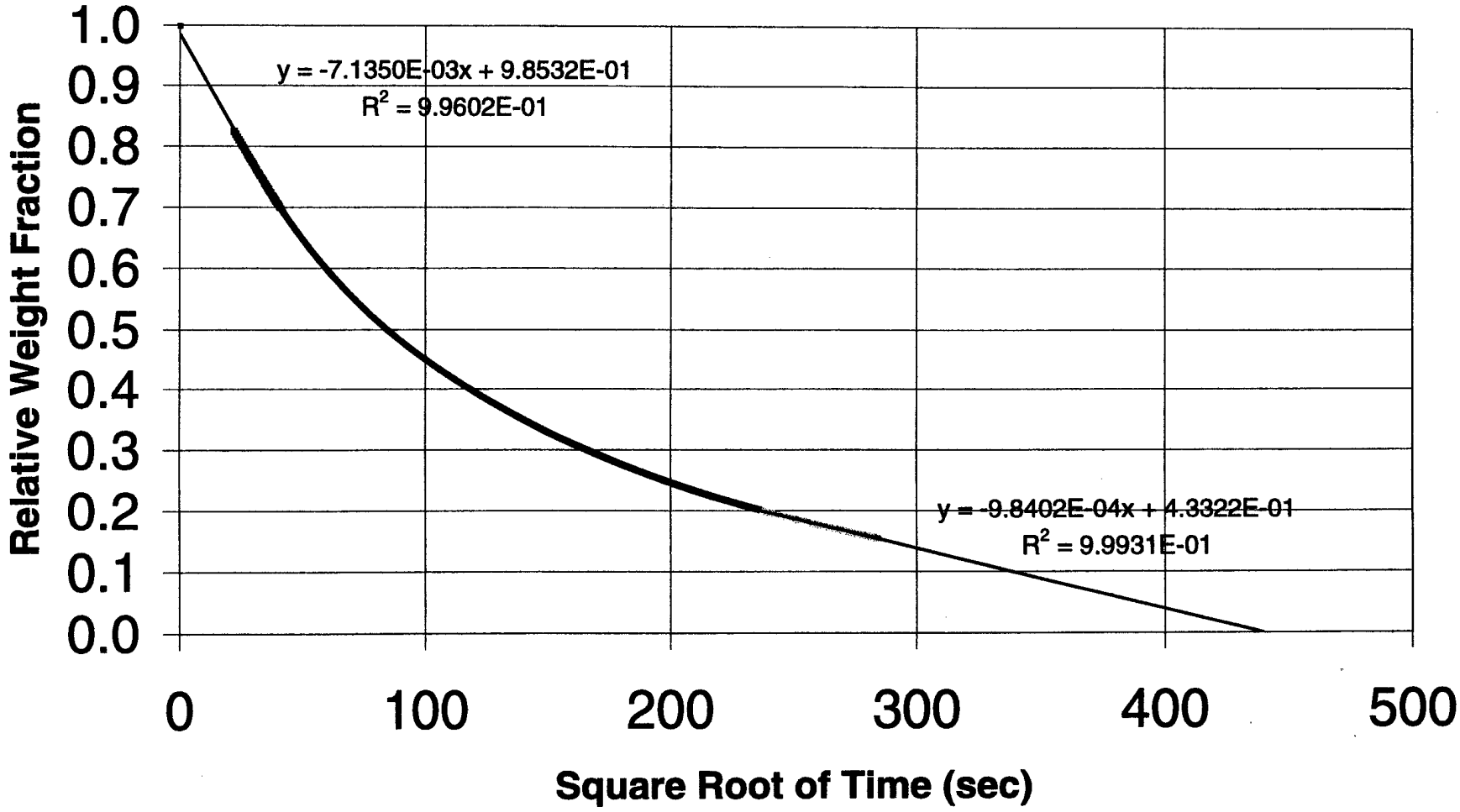
DIAMETER STATISTICS

	Column1	
	Mean	10.33
	Standard Error	0.02738613
	Median	10.31
	Mode	#N/A
	Standard Deviation	0.05477226
	Sample Variance	0.003
	Kurtosis	2.92222222
	Skewness	1.70402573
	Range	0.12
	Minimum	10.29
	Maximum	10.41
ND/value	Sum	41.32
ND/value	Count	4
A/D	Confidence Level(95.0%)	0.08715496

THICKNESS STATISTICS

	Column1	
	Mean	38.4
	Standard Error	0.16832508
	Median	38.25
	Mode	38.2
	Standard Deviation	0.33665016
	Sample Variance	0.11333333
	Kurtosis	3.57612457
Plexiglass (76B818)	Skewness	1.88710473
pmma075z	Range	0.7
	Minimum	38.2
	Maximum	38.9
	Sum	153.6
	Count	4
	Confidence Level(95.0%)	0.53568604

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PMMA (075z)



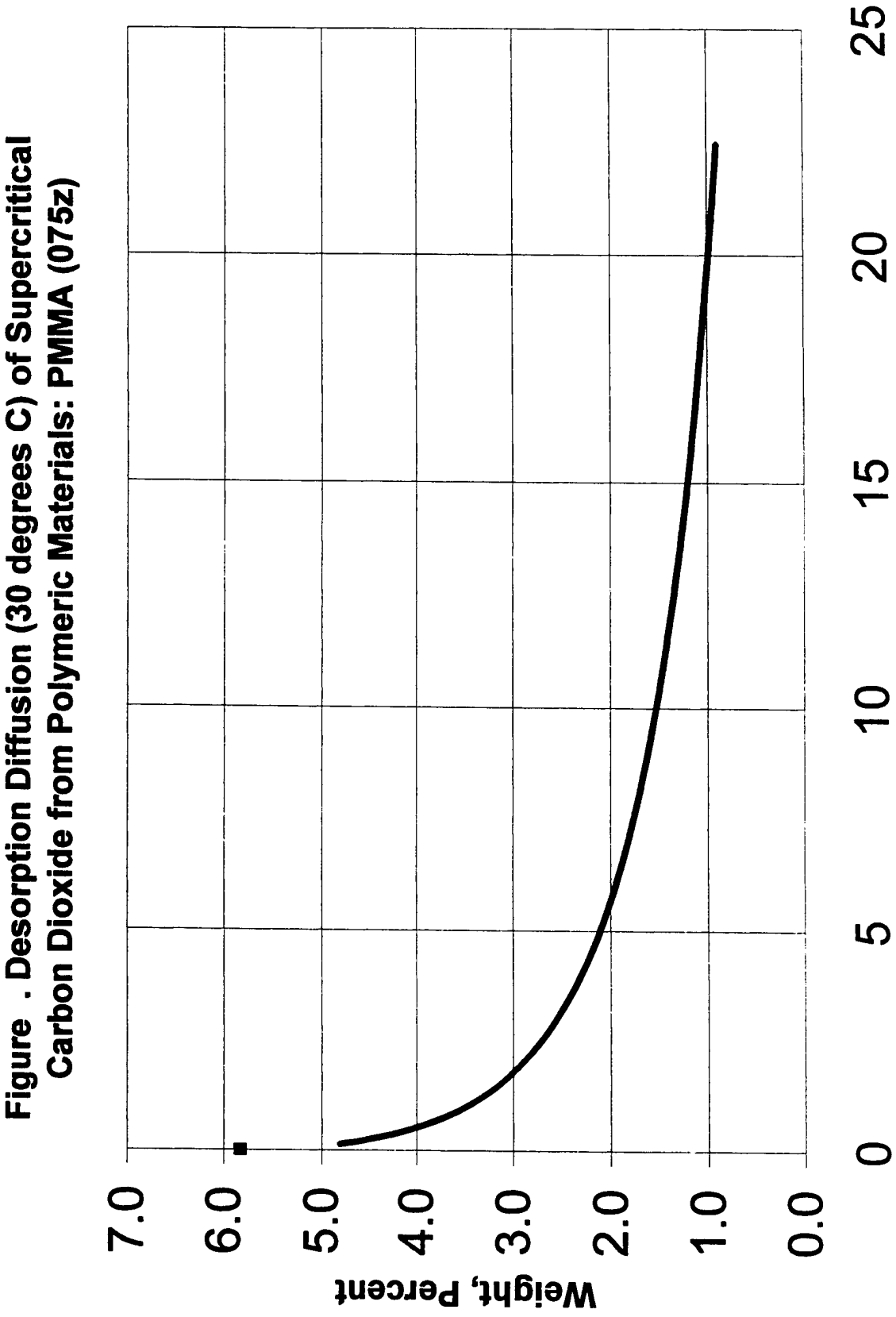


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PMMA (075z)
Weight, Percent
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
5
10
15
20
25
Time, Hours

Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PMMA (075z)

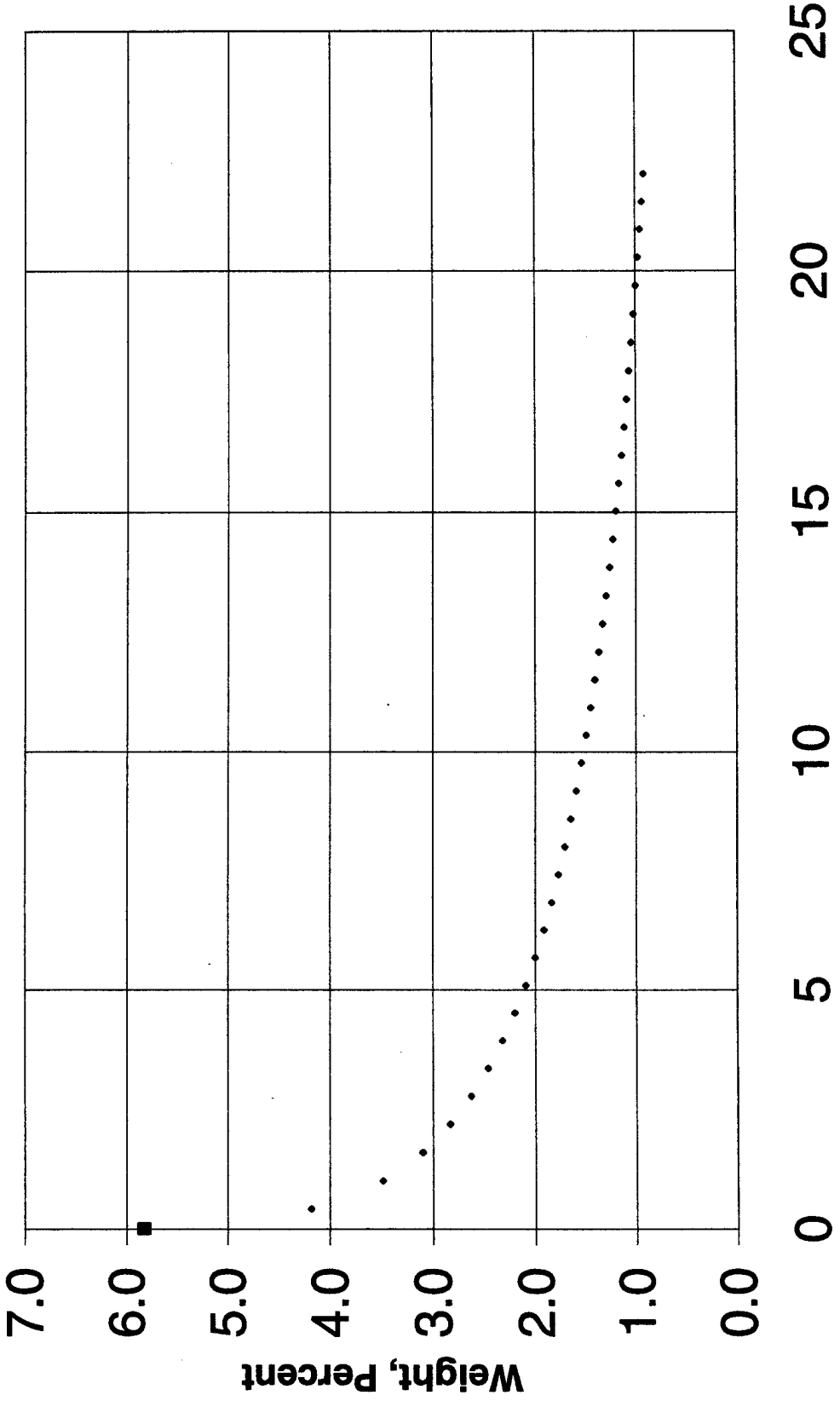
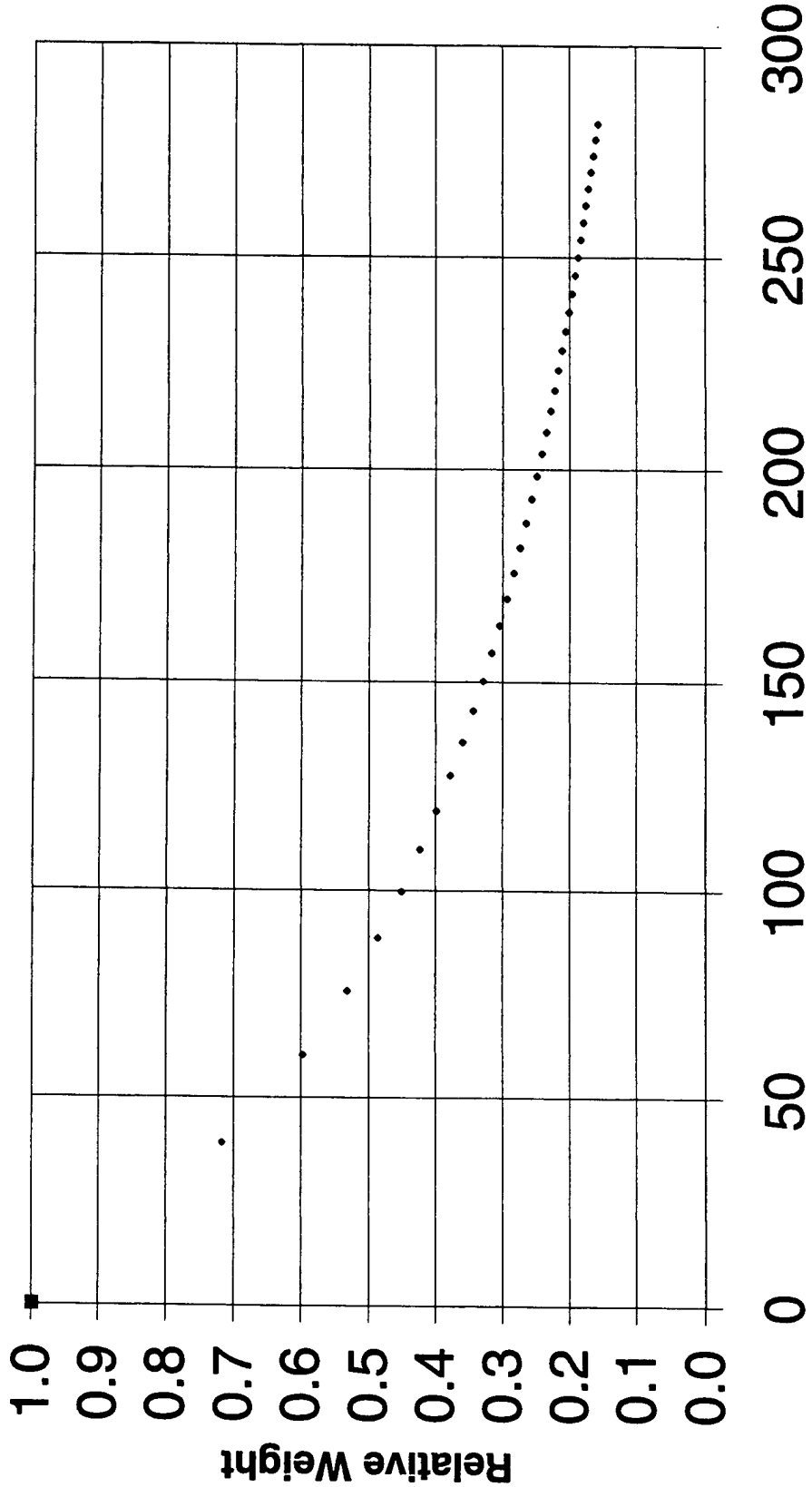


Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PMMA (075z)



TGA Time, min	Temp., deg C	TGA Wt., mg	TGA Time, sec	Adjusted Time, sec	Adjusted Time, hr	SQRT Adj. Time, sec	Wt. Loss, %	Fractional Wt. Loss	Wt. @ Zero Time, mg	Wt. @ Zero Time, %	TGA Dry Wt., mg #	Adjustment to TGA Time, sec	Hardness Scale
A	B	C	D	E	F	G	H	I	J	K	L	M	N
17.441	29.995	94.703	1046.460	1526.460	0.424	39.07	4.184	0.718	96.20	5.831	90.9	480	Shore D
52.464	30.001	94.065	3147.840	3627.840	1.008	60.23	3.482	0.597					
87.515	30.000	93.718	5250.900	5730.900	1.592	75.70	3.100	0.532					Pre Exposure
122.531	30.000	93.478	7351.860	7831.860	2.176	88.50	2.836	0.486	Formulae Used for Analysis of Data				Hardness
157.545	30.000	93.293	9452.700	9932.700	2.759	99.66	2.632	0.451	Uppercase letters refer to columns				80.2
192.572	30.000	93.142	11554.320	12034.320	3.343	109.70	2.466	0.423	Lowercase n refers to row, beginning with n=4				
227.614	30.000	93.013	13656.840	14136.840	3.927	118.90	2.325	0.399	----------				Post Desorption
262.634	30.000	92.902	15758.040	16238.040	4.511	127.43	2.203	0.378	Dn = (An * 60)				Hardness
297.694	30.001	92.806	17861.640	18341.640	5.095	135.43	2.097	0.360	En = (Dn + M4)				79.5
332.732	30.000	92.720	19963.920	20443.920	5.679	142.98	2.002	0.343	Fn = (En / 3600)				
367.752	30.001	92.643	22065.120	22545.120	6.263	150.15	1.918	0.329	Gn = SQRT (En)				Change in
402.766	30.000	92.575	24165.960	24645.960	6.846	156.99	1.842	0.316	Hn = (((Cn - L4) / L4) * 100)				Hardness, %
437.811	30.000	92.513	26268.660	26748.660	7.430	163.55	1.774	0.304	In = ((Cn - L4) / (J4 - L4))				-0.87
472.841	30.000	92.455	28370.460	28850.460	8.014	169.85	1.711	0.293	K4 = (((J4 - L4) / L4) * 100)				
507.894	30.000	92.402	30473.640	30953.640	8.598	175.94	1.652	0.283	N16 = (((N12 - N8) / N8) * 100)				
542.918	30.000	92.352	32575.080	33055.080	9.182	181.81	1.598	0.274					
577.945	30.000	92.306	34676.700	35156.700	9.766	187.50	1.546	0.265					
612.993	30.000	92.261	36779.580	37259.580	10.350	193.03	1.498	0.257	Source binary TA data file : pmma075z				
648.015	30.000	92.221	38880.900	39360.900	10.934	198.40	1.453	0.249	14 lines in the parameter block				
683.029	30.000	92.182	40981.740	41461.740	11.517	203.62	1.410	0.242	3 channels of data				
718.051	30.000	92.146	43083.060	43563.060	12.101	208.72	1.370	0.235	----------				
753.066	30.000	92.111	45183.960	45663.960	12.684	213.69	1.333	0.229	Run 20				
788.113	30.000	92.079	47286.780	47766.780	13.269	218.56	1.297	0.223	Module TGA 1000 øC				
823.150	30.000	92.049	49389.000	49869.000	13.853	223.31	1.264	0.217	Sample PMMA sorbed in SCO2				
858.221	30.000	92.019	51493.260	51973.260	14.437	227.98	1.231	0.211	Size 95.283 mg				
893.287	30.000	91.992	53597.220	54077.220	15.021	232.55	1.201	0.206	Method DESORPTION-Isothermal				
928.350	30.000	91.965	55701.000	56181.000	15.606	237.03	1.172	0.201	Operator BSI				
963.405	30.000	91.939	57804.300	58284.300	16.190	241.42	1.143	0.196	Comment Dry weight: 90.9 mg				
998.425	30.000	91.915	59905.500	60385.500	16.774	245.73	1.116	0.191	Nsig 3				
1033.452	30.000	91.891	62007.120	62487.120	17.358	249.97	1.090	0.187	Sig1 Time (min)				
1068.495	30.000	91.869	64109.700	64589.700	17.942	254.15	1.066	0.183	Sig2 Temperature (øC)				
1103.521	30.000	91.848	66211.260	66691.260	18.525	258.25	1.043	0.179	Sig3 Weight (mg)				
1138.539	30.000	91.827	68312.340	68792.340	19.109	262.28	1.019	0.175	Kcell 1.0000				
1173.591	30.000	91.806	70415.460	70895.460	19.693	266.26	0.996	0.171	Date 15-Mar-00				
1208.602	30.000	91.786	72516.120	72996.120	20.277	270.18	0.975	0.167	Time 11:35				
1243.609	30.000	91.767	74616.540	75096.540	20.860	274.04	0.953	0.163					
1278.644	30.000	91.748	76718.640	77198.640	21.444	277.85	0.933	0.160					
1313.721	30.000	91.730	78823.260	79303.260	22.029	281.61	0.913	0.157	# Other balance used to obtain dry sample wt.				

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FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Polyphenylene Oxide PPO

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	02-1-1	TGA Filename:	ppo0091d
Property Test Specification:	ASTM D471/D543		
Material Name:	Polyphenylene Oxide	Material Code:	PPO
Material Supplier:	Harbor City Plastics	Material Class:	TP
Monomer Source:	General Electric	Base Polymer (Lot. No.):	Noryl (NC8781)
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	1

Pre-Exposure Data

Measured Diameter (mm):	10.14	10.03	10.01	10.08	
Mean Diameter:	10.065		95% Confidence Level (CL):		0.092
Measured Thickness (mils):	35.10	36.10	34.30	34.90	
Mean Thickness:	35.100		95% Confidence Level (CL):		1.191
Initial Sample Weight (mg):	74.200				
Initial Durometer Hardness:	76.2	Scale: SHORE	D		

Sample Exposure Data

Exposure Date:	03/31/00	Time:	14:12:00
Removal Date:	03/31/00	Time:	14:27:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	76.90
Weight Gain (mg):	2.70	Percent Weight Gain:	3.64
Final Durometer Hardness After Desorption:	76.6	Percent Hardness Change:	0.5

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.000	95% CL:	0.0006
Time Lapse Between Sample Exposure and Sample Desorption (sec):			495
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			74.380
Sample Extracted (mg):	-0.18	Solubility Corrected for Extractables (mg):	2.70
Sample Extracted (%):	-0.24	Solubility Corrected for Extractables (%):	3.64

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm^2/sec):			2.7634E-07
Range Including Intercept (0,1), Relative Weight Fraction:			1.00 - 0.55
Linear Range of Desorption, Relative Weight Fraction:			0.70 - 0.55
Slope:	-1.3307E-02	X-axis Intercept:	7.4801E+01
R Square:	0.99852	Y-axis Intercept:	9.9534E-01

Low Concentration Diffusion Coefficient (cm^2/sec):			1.6204E-10
Linear Range of Desorption, Relative Weight Fraction:			0.10 - 0.07
Slope:	-3.2222E-04	X-axis Intercept:	4.6923E+02
R Square:	0.94367	Y-axis Intercept:	1.5119E-01

Wt. @ Zero Time, mg	Wt. @ Zero Time, %	Adjustment to TGA Time, sec	Hardness Shore Scale
K	L	M	N
76.90	3.639	495	D
TGA Dry Wt., mg	Equil. Wt. Of Desorb. Sample	Min. Wt. Used For FDC, mg.	Pre Exposure Hardness
74.200	74.38	74.200	76.2
High Conc. DC, cm2/sec	Low Conc. DC, cm2/sec	Total Liquid Sorbed, mg.	Post Desorption Hardness
2.7634E-07	1.6204E-10	2.700	76.6
R Square	R Square		Change in Hardness, %
0.99852	0.94367		0.5
X Intercept	X Intercept		
74.80	469.2		Mean Thickness, cm.
Y Intercept	Y Intercept		0.0892
0.99534	0.15119		
			ppo0091d
Y Intercept as Wt., mg.	X Intercept as Time, hrs.	X Intercept as Time, min.	X Intercept as Time, days
76.542	61.2	367.0	2.5
		Max. TGA Wt., (orig data file)	TGA Wt. At 20 min. Adjustment
		76.104	75.665
		Sorption @ 7-12 min., mg	Sorption @ 20 min., mg
		1.90	1.47
		Sorption @ 7-12 min., %	Sorption @ 20 min., %
		2.57	1.97
		Rel. Error (%) of 7-12 min. Sorp.	Rel. Error (%) of 20 min. Sorp
		-29.5	-45.7

TEMPERATURE STATISTICS

Column1	
Mean	30.0000646
Standard Error	0.000327842
Median	30
Mode	30
Standard Deviation	0.01815015
Sample Variance	0.000329428
Kurtosis	568.6634763
Skewness	-15.90073963
Range	0.83
Minimum	29.389
Maximum	30.219
Sum	91950.198
Count	3065
Confidence Level(95.0%)	0.000642813

HIGH CONCENTRATION DIFFUSION COEFFICIENT

ppo0091d

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.99925928
R Square	0.998519109
Adjusted R Square	0.998451796
Standard Error	0.003572855
Observations	24

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.189359346	0.189359346	14833.9224	1.26428E-32
Residual	22	0.000280836	1.27653E-05		
Total	23	0.189640182			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.995342921	0.003090509	322.0643683	6.5574E-42	0.98893359	1.001752251
X Variable 1	-0.013306511	0.000109254	-121.7945911	1.2643E-32	-0.01353309	-0.013079933

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.971426552
R Square	0.943669547
Adjusted R Square	0.943624518
Standard Error	0.001953709
Observations	1253

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.079993303	0.079993303	20957.2359	0
Residual	1251	0.004775039	3.81698E-06		
Total	1252	0.084768343			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.151194785	0.000493793	306.1905226	0	0.150226031	0.152163539
X Variable 1	-0.00032222	2.2258E-06	-144.7661422	0	-0.000326587	-0.000317854

DIAMETER STATISTICS

	Column1
Mean	10.065
Standard Error	0.02901149
Median	10.055
Mode	#N/A
Standard Deviation	0.05802298
Sample Variance	0.00336667
Kurtosis	-1.0475444
Skewness	0.73716094
Range	0.13
Minimum	10.01
Maximum	10.14
Sum	40.26
Count	4
Confidence Level(95.0%)	0.0923276

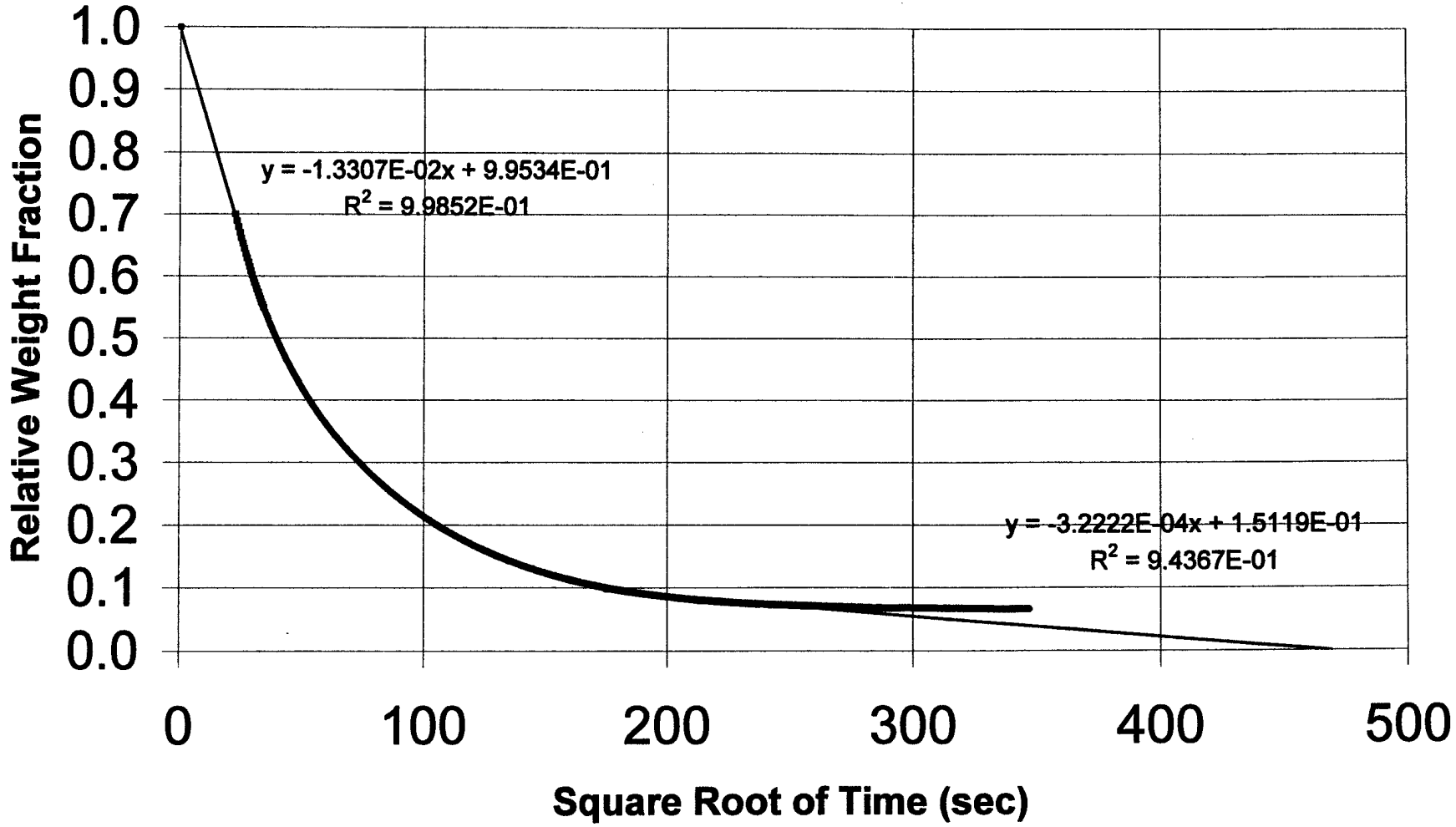
ND/value
ND/value
A/D

THICKNESS STATISTICS

	Column1
Mean	35.1
Standard Error	0.37416574
Median	35
Mode	#N/A
Standard Deviation	0.74833148
Sample Variance	0.56
Kurtosis	1.5
Skewness	0.76360355
Range	1.8
Minimum	34.3
Maximum	36.1
Sum	140.4
Count	4
Confidence Level(95.0%)	1.19076349

Noryl (NC8781)
ppo0091d

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PPO (0091d)



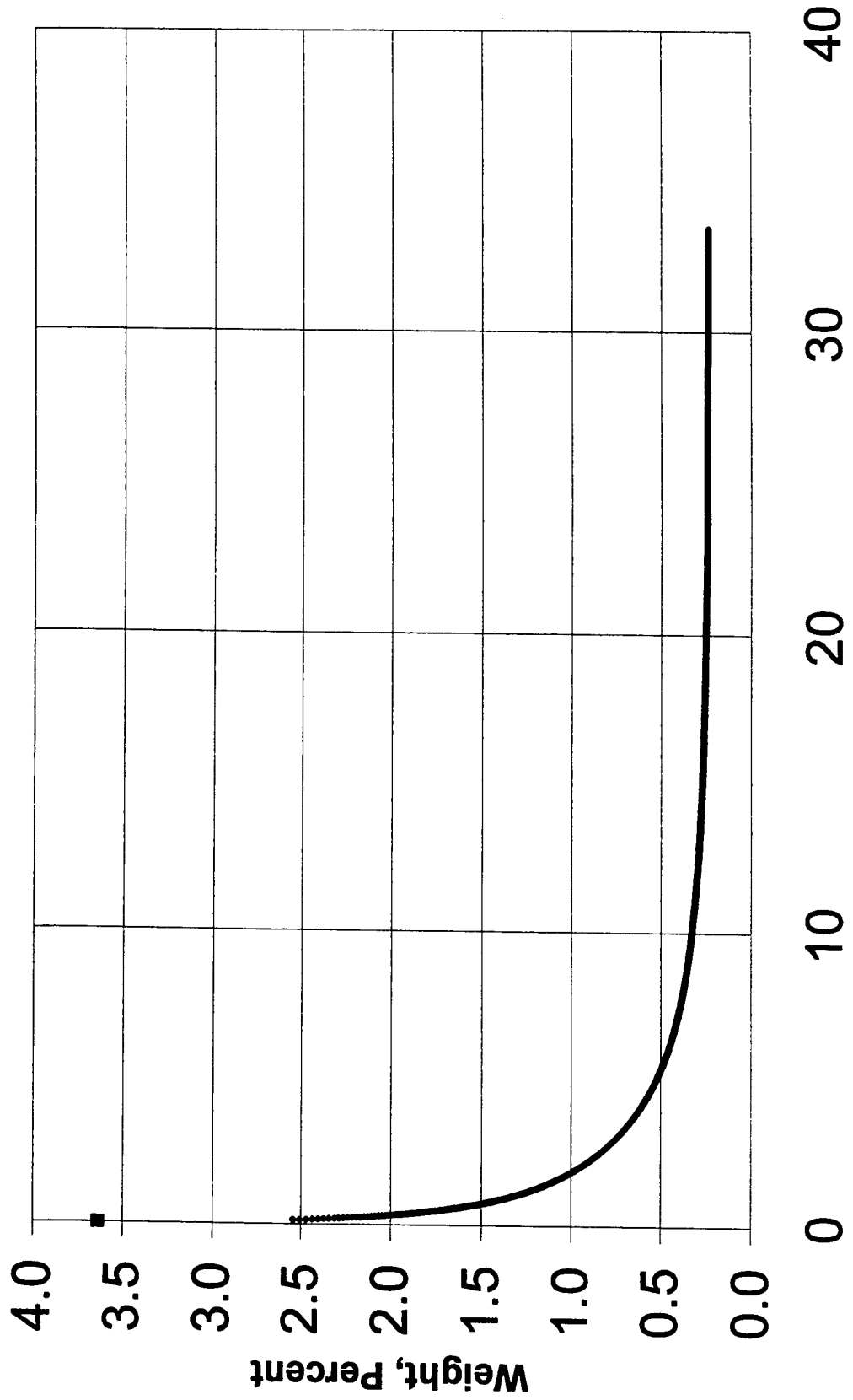


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PPO (0091d)

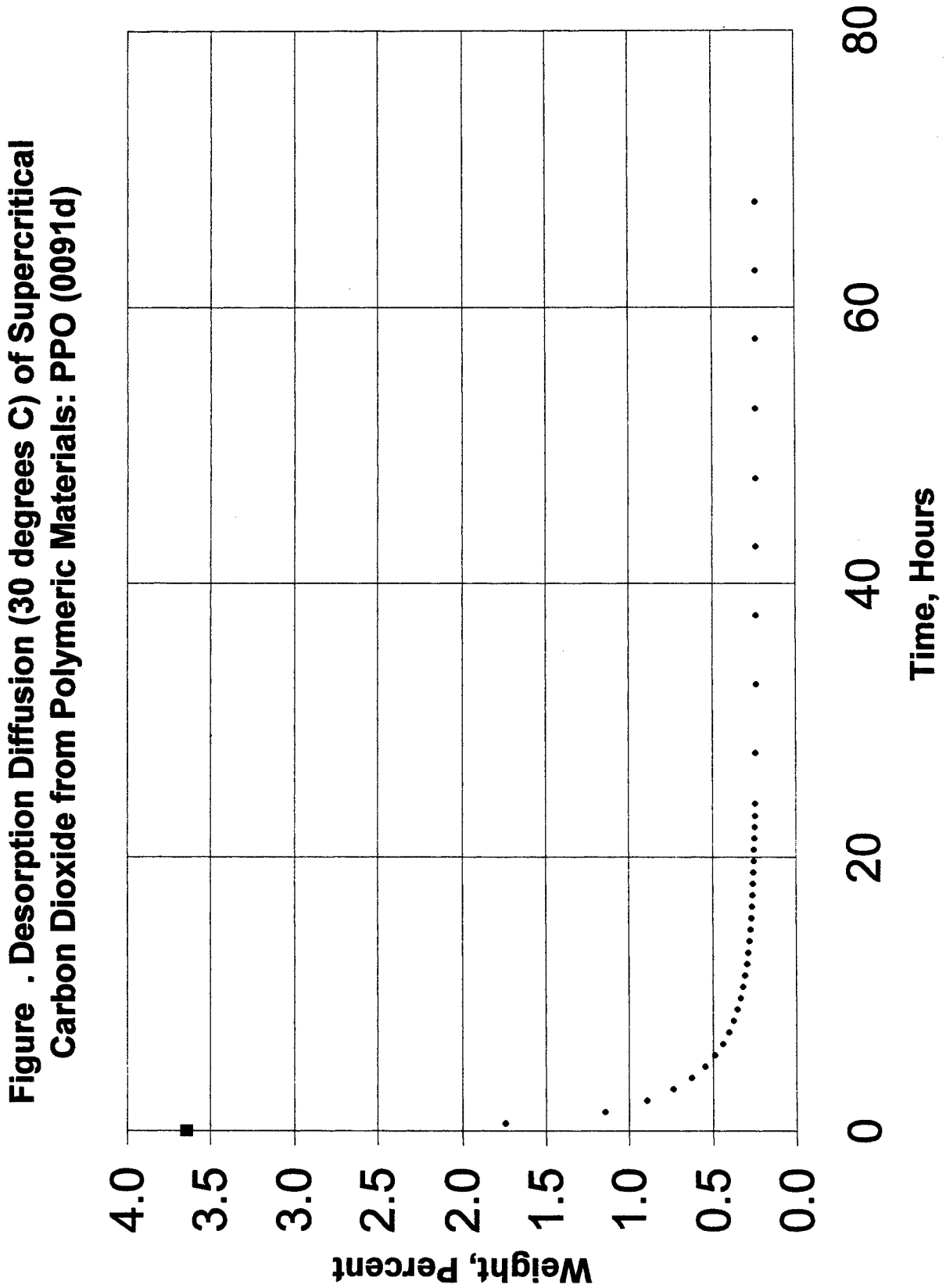
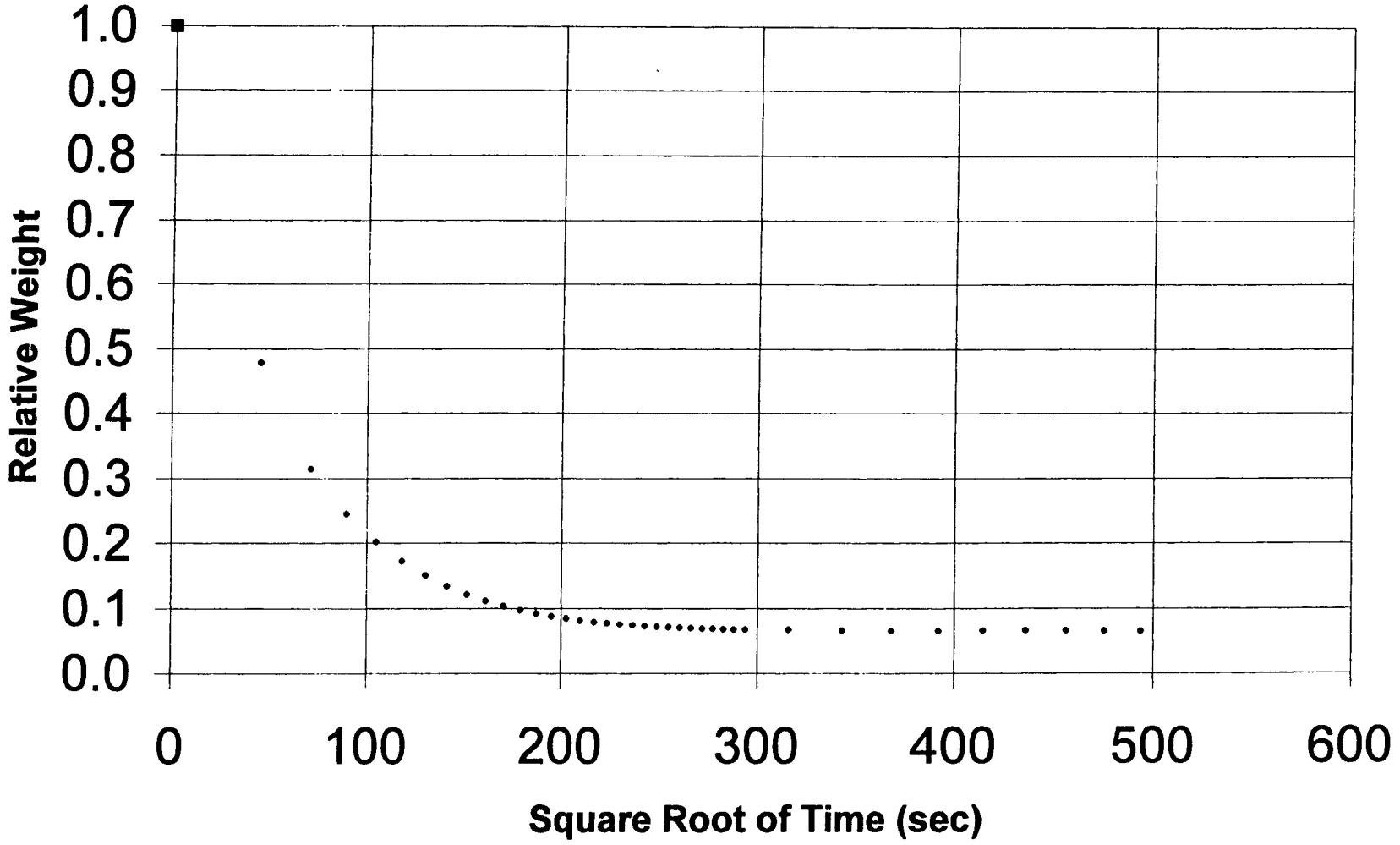


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PPO (0091d)
Weight, Percent
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
20
40
60
80
Time, Hours

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PPO (0091d)



TGA Time, min	Temp., deg C	TGA Wt., mg	TGA Time, sec	Adjusted Time, sec	Adjusted Time, hr	SQRT Adj. Time, sec	Wt. Loss, %	Fractional Wt. Loss	Wt. @ Zero Time, mg	Wt. @ Zero Time, %	TGA Dry Wt., mg #	Adjustment to TGA Time, sec	Hardness Scale
A	B	C	D	E	F	G	H	I	J	K	L	M	N
24.916	29.998	75.492	1494.960	1989.960	0.553	44.61	1.741	0.479	76.90	3.639	74.2	495	Shore D
74.926	30.000	75.050	4495.560	4990.560	1.386	70.64	1.145	0.315					
125.014	30.000	74.862	7500.840	7995.840	2.221	89.42	0.892	0.245					
175.068	30.000	74.746	10504.080	10999.080	3.055	104.88	0.736	0.202					
225.133	30.000	74.666	13507.980	14002.980	3.890	118.33	0.627	0.172					
275.195	30.000	74.607	16511.700	17006.700	4.724	130.41	0.548	0.151					
325.262	30.000	74.562	19515.720	20010.720	5.559	141.46	0.488	0.134					
375.274	30.000	74.528	22516.440	23011.440	6.392	151.70	0.442	0.121					
425.303	30.000	74.501	25518.180	26013.180	7.226	161.29	0.406	0.112					
475.370	30.000	74.480	28522.200	29017.200	8.060	170.34	0.377	0.104					
525.462	30.000	74.463	31527.720	32022.720	8.895	178.95	0.354	0.097					
575.508	30.000	74.449	34530.480	35025.480	9.729	187.15	0.335	0.092					
625.592	30.001	74.438	37535.520	38030.520	10.564	195.01	0.320	0.088					
675.639	30.000	74.428	40538.340	41033.340	11.398	202.57	0.308	0.085					
725.724	30.000	74.420	43543.440	44038.440	12.233	209.85	0.296	0.081					
775.767	30.000	74.414	46546.020	47041.020	13.067	216.89	0.288	0.079					
825.823	30.000	74.408	49549.380	50044.380	13.901	223.71	0.281	0.077					
875.876	30.000	74.404	52552.560	53047.560	14.735	230.32	0.275	0.075					
925.921	30.000	74.400	55555.260	56050.260	15.570	236.75	0.270	0.074					
975.959	30.000	74.397	58557.540	59052.540	16.403	243.01	0.266	0.073					
1025.996	30.000	74.395	61559.760	62054.760	17.237	249.11	0.263	0.072					
1076.065	30.000	74.392	64563.900	65058.900	18.072	255.07	0.259	0.071					
1126.120	30.000	74.391	67567.200	68062.200	18.906	260.89	0.257	0.071					
1176.203	30.000	74.389	70572.180	71067.180	19.741	266.58	0.254	0.070					
1226.287	30.000	74.387	73577.220	74072.220	20.576	272.16	0.252	0.069					
1276.365	30.000	74.386	76581.900	77076.900	21.410	277.63	0.250	0.069					
1326.441	30.000	74.384	79586.460	80081.460	22.245	282.99	0.248	0.068					
1376.496	30.000	74.383	82589.760	83084.760	23.079	288.24	0.246	0.068					
1432.230	30.000	74.382	85933.800	86428.800	24.008	293.99	0.245	0.067					
1654.891	30.000	74.381	99293.460	99788.460	27.719	315.89	0.244	0.067					
1954.896	30.000	74.378	117293.760	117788.760	32.719	343.20	0.239	0.066					
2254.896	30.000	74.377	135293.760	135788.760	37.719	368.50	0.239	0.066					
2554.916	30.000	74.377	153294.960	153789.960	42.719	392.16	0.239	0.066					
2854.918	30.000	74.377	171295.080	171790.080	47.719	414.48	0.238	0.066					
3154.921	30.000	74.378	189295.260	189790.260	52.720	435.65	0.239	0.066					
3454.927	30.000	74.377	207295.620	207790.620	57.720	455.84	0.238	0.065					
3754.941	30.000	74.376	225296.460	225791.460	62.720	475.18	0.237	0.065					
4054.946	30.000	74.374	243296.760	243791.760	67.720	493.75	0.235	0.065					

Formulae Used for Analysis of Data
Uppercase letters refer to columns
Lowercase n refers to row, beginning with n=4

Dn = (An * 60)
En = (Dn + M4)
Fn = (En / 3600)
Gn = SQRT (En)
Hn = (((Cn - L4) / L4) * 100)
In = ((Cn - L4) / (J4 - L4))
K4 = (((J4 - L4) / L4) * 100)
N16 = (((N12 – N8) /N8) * 100)

Source binary TA data file : ppo0091d.01
14 lines in the parameter block
3 channels of data

Run 25
Module TGA Aluminum Pans
Sample PPO SCCO2 0091D
Size 76.104 mg
Method DESORPTION-Isothermal
Operator WJS
Comment Disk: .4x0.03 in. HP@1400x50 Dry Wt, DS: 74.2 ET: 8:00
Nsig 3
Sig1 Time (min)
Sig2 Temperature (øC)
Sig3 Weight (mg)
Kcell 1.0000
Date 31-Mar-00
Time 14:36

Other balance used to obtain dry sample wt.

Hardness Scale
Pre Exposure Hardness 76.2
Post Desorption Hardness 76.6
Change in Hardness, % 0.52

Blank

FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Polyphenylene Oxide PPO

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	02-1-2	TGA Filename:	ppo0096d
Property Test Specification:	ASTM D471/D543		
Material Name:	Polyphenylene Oxide	Material Code:	PPO
Material Supplier:	Harbor City Plastics	Material Class:	TP
Monomer Source:	General Electric	Base Polymer (Lot. No.):	Noryl (NC8781)
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	2

Pre-Exposure Data

Measured Diameter (mm):	10.16	10.1	10.06	10.18	
Mean Diameter:	10.125		95% Confidence Level (CL):		0.088
Measured Thickness (mils):	33.40	34.00	33.70	33.20	
Mean Thickness:	33.575		95% Confidence Level (CL):		0.557
Initial Sample Weight (mg):	69.900				
Initial Durometer Hardness:	75.6	Scale: SHORE	D		

Sample Exposure Data

Exposure Date:	04/06/00	Time:	10:49:00
Removal Date:	04/06/00	Time:	11:04:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	72.90
Weight Gain (mg):	3.00	Percent Weight Gain:	4.29
Final Durometer Hardness After Desorption:	75.8	Percent Hardness Change:	0.3

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.000	95% CL:	0.0007
Time Lapse Between Sample Exposure and Sample Desorption (sec):			465
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			70.020
Sample Extracted (mg):	-0.12	Solubility Corrected for Extractables (mg):	3.00
Sample Extracted (%):	-0.17	Solubility Corrected for Extractables (%):	4.29

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm^2/sec):			3.2831E-07
Range Including Intercept (0,1), Relative Weight Fraction:			1.00 - 0.50
Linear Range of Desorption, Relative Weight Fraction:			0.63 - 0.50
Slope:	-1.5163E-02	X-axis Intercept:	6.4395E+01
R Square:	0.98852	Y-axis Intercept:	9.7639E-01

Low Concentration Diffusion Coefficient (cm^2/sec):			5.0719E-11
Linear Range of Desorption, Relative Weight Fraction:			0.07 - 0.04
Slope:	-1.8846E-04	X-axis Intercept:	4.9037E+02
R Square:	0.86699	Y-axis Intercept:	9.2416E-02

Wt. @ Zero Time, mg K 72.90	Wt. @ Zero Time, % L 4.292	Adjustment to TGA Time, sec M 465	Hardness Shore Scale N D
TGA Dry Wt., mg 69.900	Equil. Wt. Of Desorb. Sample 70.02	Min. Wt. Used For FDC, mg. 69.900	Pre Exposure Hardness 75.6
High Conc. DC, cm2/sec 3.2831E-07	Low Conc. DC, cm2/sec 5.0719E-11	Total Liquid Sorbed, mg. 3.000	Post Desorption Hardness 75.8
R Square 0.98852	R Square 0.86699		Change in Hardness, % 0.3
X Intercept 64.39	X Intercept 490.4		Mean Thickness, cm. 0.0853
Y Intercept 0.97639	Y Intercept 0.09242		
Y Intercept as Wt., mg. 71.179	X Intercept as Time, hrs. 66.8	X Intercept as Time, min. 400.8	**ppo0096d** X Intercept as Time, days 2.8
		Max. TGA Wt., (orig data file) 71.818	TGA Wt. At 20 min. Adjustment 71.335
		Sorption @ 7-12 min., mg 1.92	Sorption @ 20 min., mg 1.43
		Sorption @ 7-12 min., % 2.74	Sorption @ 20 min., % 2.05
		Rel. Error (%) of 7-12 min. Sorp. -36.1	Rel. Error (%) of 20 min. Sorp -52.2

TEMPERATURE STATISTICS

Column1	
Mean	30.00018117
Standard Error	0.000342847
Median	30
Mode	30.001
Standard Deviation	0.018665481
Sample Variance	0.0003484
Kurtosis	477.8445073
Skewness	-13.7793311
Range	0.815
Minimum	29.414
Maximum	30.229
Sum	88920.537
Count	2964
Confidence Level(95.0%)	0.000672242

HIGH CONCENTRATION DIFFUSION COEFFICIENT

ppo0096d

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.994245135
R Square	0.988523388
Adjusted R Square	0.987949557
Standard Error	0.011315319
Observations	22

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.220565126	0.220565126	1722.67459	7.02123E-21
Residual	20	0.002560729	0.000128036		
Total	21	0.223125855			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.97639493	0.009936018	98.2682294	2.5088E-28	0.955668769	0.997121092
X Variable 1	-0.015162683	0.000365321	-41.50511524	7.0212E-21	-0.015924729	-0.014400638

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.93112234
R Square	0.866988812
Adjusted R Square	0.866922638
Standard Error	0.002762891
Observations	2012

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.100011233	0.100011233	13101.5108	0
Residual	2010	0.015343465	7.63356E-06		
Total	2011	0.115354699			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.092415842	0.000394355	234.3466947	0	0.091642455	0.093189229
X Variable 1	-0.000188461	1.64649E-06	-114.4618313	0	-0.00019169	-0.000185232

DIAMETER STATISTICS

	Column1
Mean	10.125
Standard Error	0.02753785
Median	10.13
Mode	#N/A
Standard Deviation	0.05507571
Sample Variance	0.00303333
Kurtosis	-3.032967
Skewness	-0.3232814
Range	0.12
Minimum	10.06
Maximum	10.18
Sum	40.5
Count	4
Confidence Level(95.0%)	0.08763782

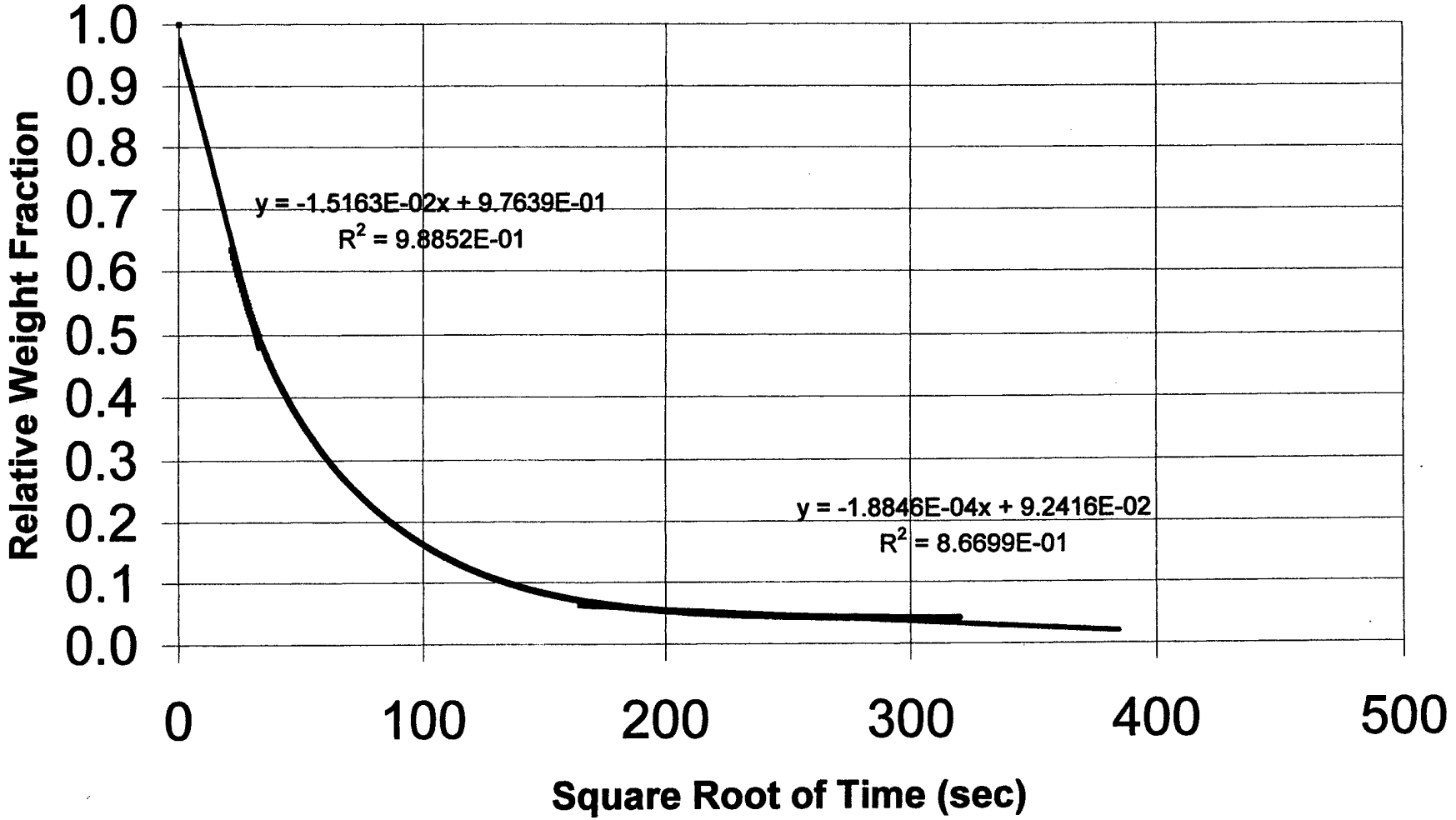
ND/value
ND/value
A/D

THICKNESS STATISTICS

	Column1
Mean	33.575
Standard Error	0.175
Median	33.55
Mode	#N/A
Standard Deviation	0.35
Sample Variance	0.1225
Kurtosis	-1.5976676
Skewness	0.32069971
Range	0.8
Minimum	33.2
Maximum	34
Sum	134.3
Count	4
Confidence Level(95.0%)	0.55692863

Noryl (NC8781)
ppo0096d

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PPO (0096d)



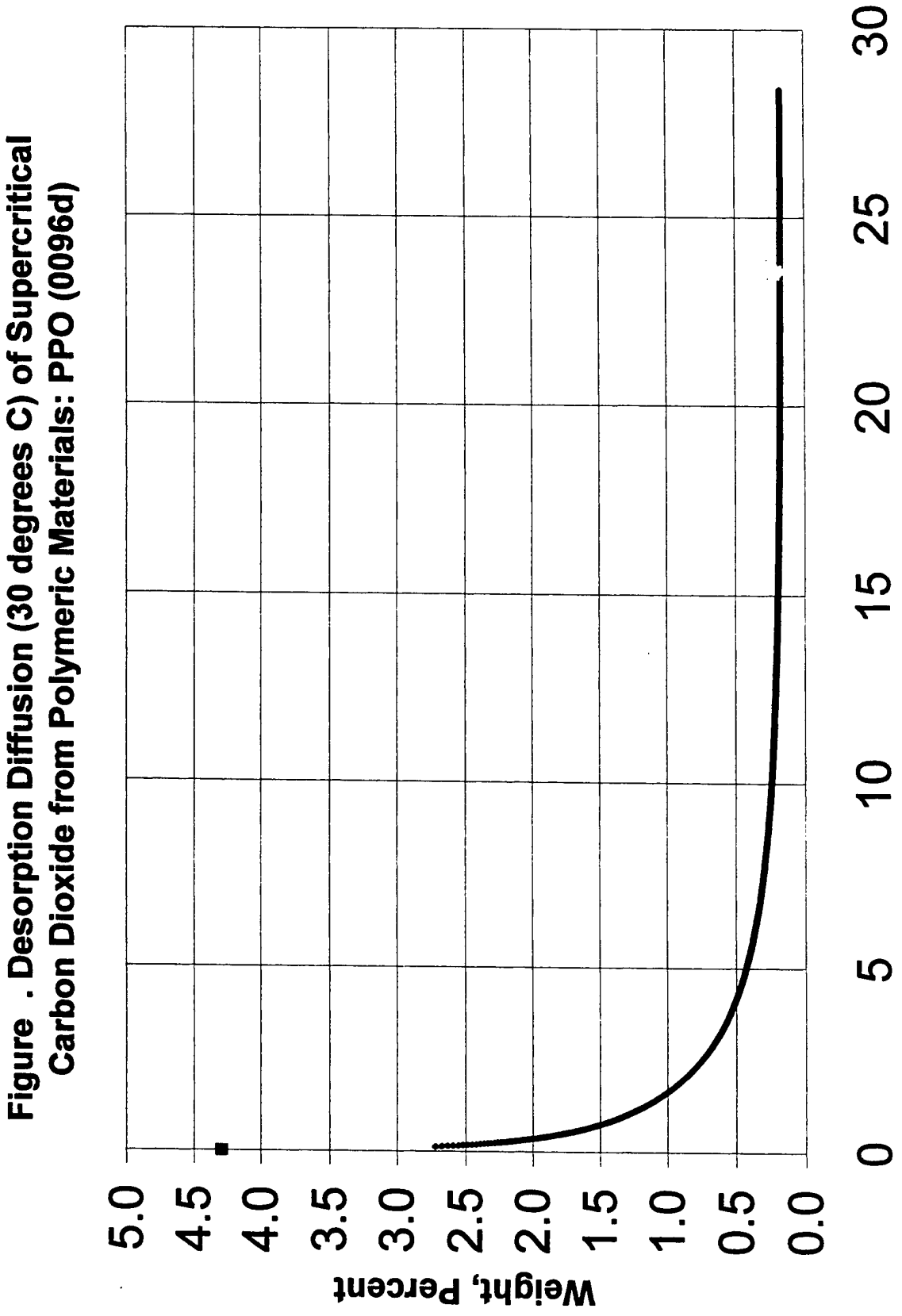


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PPO (0096d)
Weight, Percent
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
5
10
15
20
25
30
Time, Hours

TGA Time, min	Temp., deg C	TGA Wt., mg	TGA Time, sec	Adjusted Time, sec	Adjusted Time, hr	SQRT Adj. Time, sec	Wt. Loss, %	Fractional Wt. Loss	Wt. @ Zero Time, mg	Wt. @ Zero Time, %	TGA Dry Wt., mg #	Adjustment to TGA Time, sec	Hardness Scale
A	B	C	D	E	F	G	H	I	J	K	L	M	N
19.104	29.997	71.248	1146.240	1611.240	0.448	40.14	1.929	0.449	72.90	4.292	69.9	465	Shore D
57.454	30.000	70.793	3447.240	3912.240	1.087	62.55	1.277	0.298					
95.804	30.000	70.586	5748.240	6213.240	1.726	78.82	0.981	0.229					Pre Exposure
134.163	30.000	70.454	8049.780	8514.780	2.365	92.28	0.792	0.185	Formulae Used for Analysis of Data				Hardness
172.538	30.002	70.361	10352.280	10817.280	3.005	104.01	0.660	0.154	Uppercase letters refer to columns				75.6
210.936	30.002	70.294	12656.160	13121.160	3.645	114.55	0.563	0.131	Lowercase n refers to row, beginning with n=4				
249.333	30.000	70.243	14959.980	15424.980	4.285	124.20	0.491	0.114	----------				Post Desorption
287.703	30.000	70.205	17262.180	17727.180	4.924	133.14	0.436	0.101	Dn = (An * 60)				Hardness
326.083	30.000	70.174	19564.980	20029.980	5.564	141.53	0.392	0.091	En = (Dn + M4)				75.8
364.453	30.000	70.149	21867.180	22332.180	6.203	149.44	0.357	0.083	Fn = (En / 3600)				
402.827	30.000	70.129	24169.620	24634.620	6.843	156.95	0.328	0.076	Gn = SQRT (En)				Change in
441.198	30.000	70.113	26471.880	26936.880	7.482	164.12	0.305	0.071	Hn = (((Cn - L4) / L4) * 100)				Hardness, %
479.573	30.000	70.100	28774.380	29239.380	8.122	171.00	0.285	0.067	In = ((Cn - L4) / (J4 - L4))				0.26
517.956	30.000	70.088	31077.360	31542.360	8.762	177.60	0.269	0.063	K4 = (((J4 - L4) / L4) * 100)				
556.355	30.000	70.078	33381.300	33846.300	9.402	183.97	0.255	0.059	N16 = (((N12 – N8) /N8) * 100)				
594.733	30.000	70.070	35683.980	36148.980	10.041	190.13	0.243	0.057					
633.144	30.000	70.064	37988.640	38453.640	10.682	196.10	0.234	0.055					
671.575	30.000	70.058	40294.500	40759.500	11.322	201.89	0.226	0.053	Source binary TA data file : ppo0096d.01				
709.958	30.000	70.053	42597.480	43062.480	11.962	207.52	0.219	0.051	14 lines in the parameter block				
748.328	30.000	70.049	44899.680	45364.680	12.601	212.99	0.212	0.049	3 channels of data				
786.680	30.000	70.045	47200.800	47665.800	13.241	218.32	0.208	0.048	----------				
825.082	30.000	70.041	49504.920	49969.920	13.881	223.54	0.202	0.047	Run 26				
863.468	30.000	70.039	51808.080	52273.080	14.520	228.63	0.198	0.046	Module TGA Aluminum Pans				
901.822	30.000	70.037	54109.320	54574.320	15.160	233.61	0.195	0.046	Sample PPO SCCO2 0096D				
940.216	30.000	70.035	56412.960	56877.960	15.799	238.49	0.193	0.045	Size 71.818 mg				
978.594	30.000	70.033	58715.640	59180.640	16.439	243.27	0.190	0.044	Method DESORPTION-Isothermal				
1016.990	30.000	70.031	61019.400	61484.400	17.079	247.96	0.188	0.044	Operator WJS				
1055.381	30.000	70.030	63322.860	63787.860	17.719	252.56	0.186	0.043	Comment Disk: .4x0.03 in. HP@1400x50 Dry Wt, DS: 69.9 ET: 7:30				
1093.802	30.000	70.029	65628.120	66093.120	18.359	257.09	0.184	0.043	Nsig 3				
1132.167	30.000	70.027	67930.020	68395.020	18.999	261.52	0.182	0.042	Sig1 Time (min)				
1170.526	30.000	70.027	70231.560	70696.560	19.638	265.89	0.181	0.042	Sig2 Temperature (øC)				
1208.882	30.000	70.026	72532.920	72997.920	20.277	270.18	0.180	0.042	Sig3 Weight (mg)				
1247.292	30.000	70.025	74837.520	75302.520	20.917	274.41	0.179	0.042	Kcell 1.0000				
1285.691	30.000	70.025	77141.460	77606.460	21.557	278.58	0.178	0.042	Date 6-Apr-00				
1324.052	30.000	70.024	79443.120	79908.120	22.197	282.68	0.177	0.041	Time 11:13				
1362.420	30.000	70.024	81745.200	82210.200	22.836	286.72	0.177	0.041					
1400.795	30.000	70.023	84047.700	84512.700	23.476	290.71	0.176	0.041					
1459.128	30.000	70.022	87547.680	88012.680	24.448	296.67	0.175	0.041	# Other balance used to obtain dry sample wt.				

Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PPO (0096d)

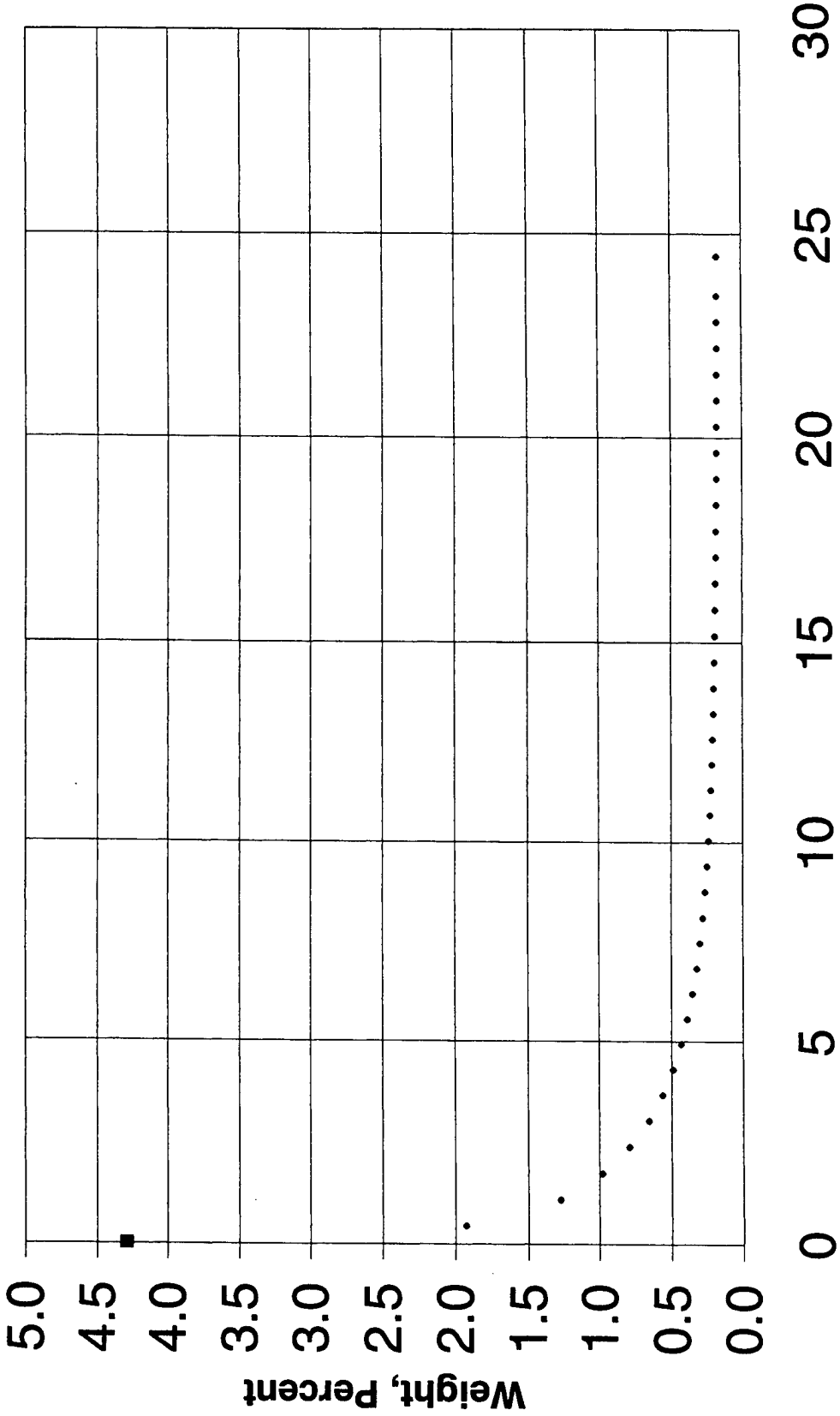


Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PPO (0096d)

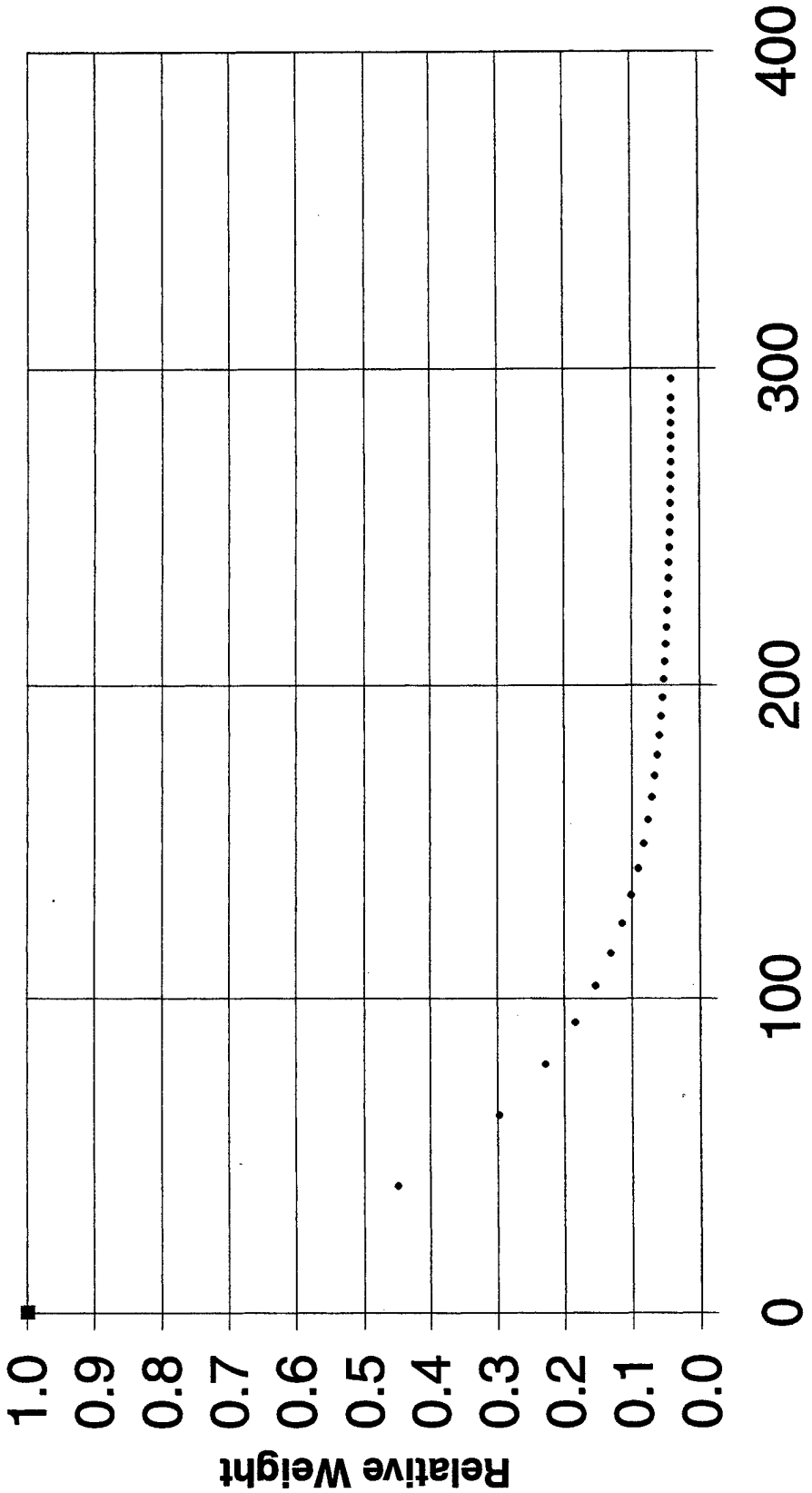


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FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Polyvinyl Chloride PVC

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	03-1-1	TGA Filename:	pvc0089d
Property Test Specification:	ASTM D471/D543		
Material Name:	Polyvinyl Chloride	Material Code:	PVC
Material Supplier:	Harbor City Plastics	Material Class:	TP
Monomer Source:	Georgia Gulf	Base Polymer (Lot. No.):	(4576T1)
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	1

Pre-Exposure Data

Measured Diameter (mm):	11.42	11.48	11.45	11.31	
Mean Diameter:	11.415		95% Confidence Level (CL):		0.118
Measured Thickness (mils):	39.80	38.50	41.00	39.00	
Mean Thickness:	39.575		95% Confidence Level (CL):		1.735
Initial Sample Weight (mg):	105.249				
Initial Durometer Hardness:	73.4	Scale: SHORE	D		

Sample Exposure Data

Exposure Date:	03/29/00	Time:	13:30:00
Removal Date:	03/29/00	Time:	13:45:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	106.80
Weight Gain (mg):	1.55	Percent Weight Gain:	1.47
Final Durometer Hardness After Desorption:	71.5	Percent Hardness Change:	-2.6

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.001	95% CL:	0.0016
Time Lapse Between Sample Exposure and Sample Desorption (sec):			660
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			105.280
Sample Extracted (mg):	-0.03	Solubility Corrected for Extractables (mg):	1.55
Sample Extracted (%):	-0.03	Solubility Corrected for Extractables (%):	1.47

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm^2/sec):			1.2426E-07
Range Including Intercept (0,1), Relative Weight Fraction:			1.00 - 0.65
Linear Range of Desorption, Relative Weight Fraction:			0.78 - 0.65
Slope:	-7.9140E-03	X-axis Intercept:	1.2501E+02
R Square:	0.99783	Y-axis Intercept:	9.8937E-01

Low Concentration Diffusion Coefficient (cm^2/sec):			1.5727E-09
Linear Range of Desorption, Relative Weight Fraction:			0.07 - 0.02
Slope:	-8.9033E-04	X-axis Intercept:	3.2360E+02
R Square:	0.99847	Y-axis Intercept:	2.8812E-01

Wt. @ Zero Time, mg	Wt. @ Zero Time, %	Adjustment to TGA Time, sec	Hardness Shore Scale
K	L	M	N
106.80	1.474	660	D
TGA Dry Wt., mg	Equil. Wt. Of Desorb. Sample	Min. Wt. Used For FDC, mg.	Pre Exposure Hardness
105.249	105.28	105.249	73.4
High Conc. DC, cm2/sec	Low Conc. DC, cm2/sec	Total Liquid Sorbed, mg.	Post Desorption Hardness
1.2426E-07	1.5727E-09	1.551	71.5
R Square	R Square		Change in Hardness, %
0.99783	0.99847		-2.6
X Intercept	X Intercept		
125.01	323.6		Mean Thickness, cm.
Y Intercept	Y Intercept		0.1005
0.98937	0.28812		
			pvc0089d
Y Intercept as Wt., mg.	X Intercept as Time, hrs.	X Intercept as Time, min.	X Intercept as Time, days
105.665	29.1	174.5	1.2
		Max. TGA Wt., (orig data file)	TGA Wt. At 20 min. Adjustment
		106.469	106.354
		Sorption @ 7-12 min., mg	Sorption @ 20 min., mg
		1.22	1.11
		Sorption @ 7-12 min., %	Sorption @ 20 min., %
		1.16	1.05
		Rel. Error (%) of 7-12 min. Sorp.	Rel. Error (%) of 20 min. Sorp
		-21.3	-28.8

TEMPERATURE STATISTICS

Column1	
Mean	30.00078699
Standard Error	0.000801693
Median	30
Mode	30
Standard Deviation	0.043321102
Sample Variance	0.001876718
Kurtosis	256.1938329
Skewness	-6.545547698
Range	1.567
Minimum	28.934
Maximum	30.501
Sum	87602.298
Count	2920
Confidence Level(95.0%)	0.00157194

DIAMETER STATISTICS

	Column1	
	Mean	11.415
	Standard Error	0.03708099
	Median	11.435
	Mode	#N/A
	Standard Deviation	0.07416198
	Sample Variance	0.0055
	Kurtosis	2.02644628
	Skewness	-1.3729161
	Range	0.17
	Minimum	11.31
	Maximum	11.48
ND/value	Sum	45.66
ND/value	Count	4
A/D	Confidence Level(95.0%)	0.11800838

THICKNESS STATISTICS

	Column1	
	Mean	39.575
	Standard Error	0.54524459
	Median	39.4
	Mode	#N/A
	Standard Deviation	1.09048919
	Sample Variance	1.18916667
	Kurtosis	-0.3686457
(4576T1)	Skewness	0.75707136
pvc0089d	Range	2.5
	Minimum	38.5
	Maximum	41
	Sum	158.3
	Count	4
	Confidence Level(95.0%)	1.73521327

HIGH CONCENTRATION DIFFUSION COEFFICIENT

pvc0089d

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.998914632
R Square	0.997830441
Adjusted R Square	0.997777525
Standard Error	0.002797958
Observations	43

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.147622177	0.147622177	18856.8519	3.08293E-56
Residual	41	0.000320971	7.82857E-06		
Total	42	0.147943149			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.989368347	0.002041735	484.572376	1.1317E-78	0.985244978	0.993491717
X Variable 1	-0.007914049	5.76321E-05	-137.3202531	3.0829E-56	-0.008030439	-0.007797659

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

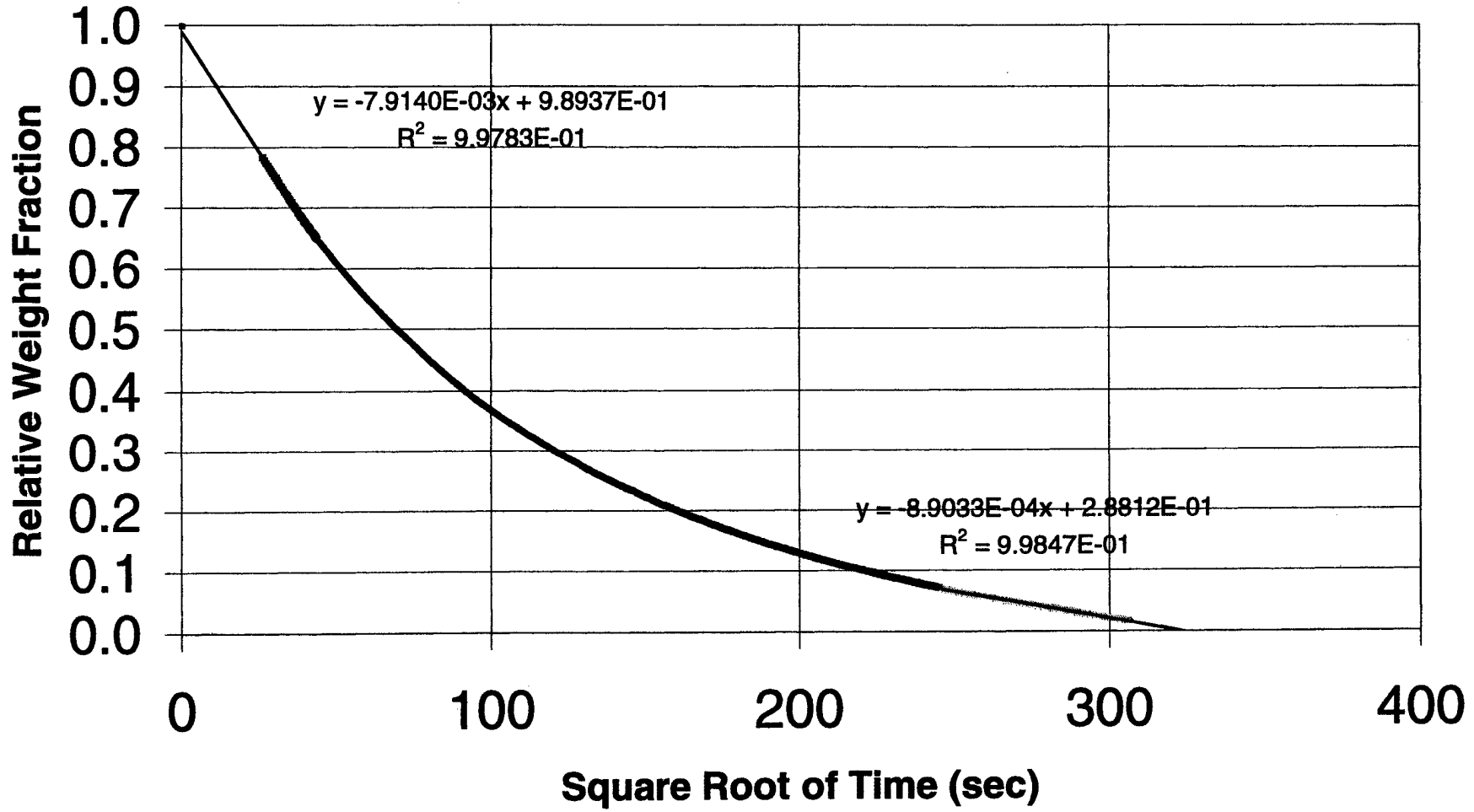
Regression Statistics	
Multiple R	0.999235225
R Square	0.998471034
Adjusted R Square	0.99846937
Standard Error	0.000523843
Observations	921

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.164685731	0.164685731	600140.821	0
Residual	919	0.000252184	2.74412E-07		
Total	920	0.164937915			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.288115378	0.000313944	917.729431	0	0.287499249	0.288731508
X Variable 1	-0.000890331	1.14928E-06	-774.6875633	0	-0.000892587	-0.000888076

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PVC (0089d)



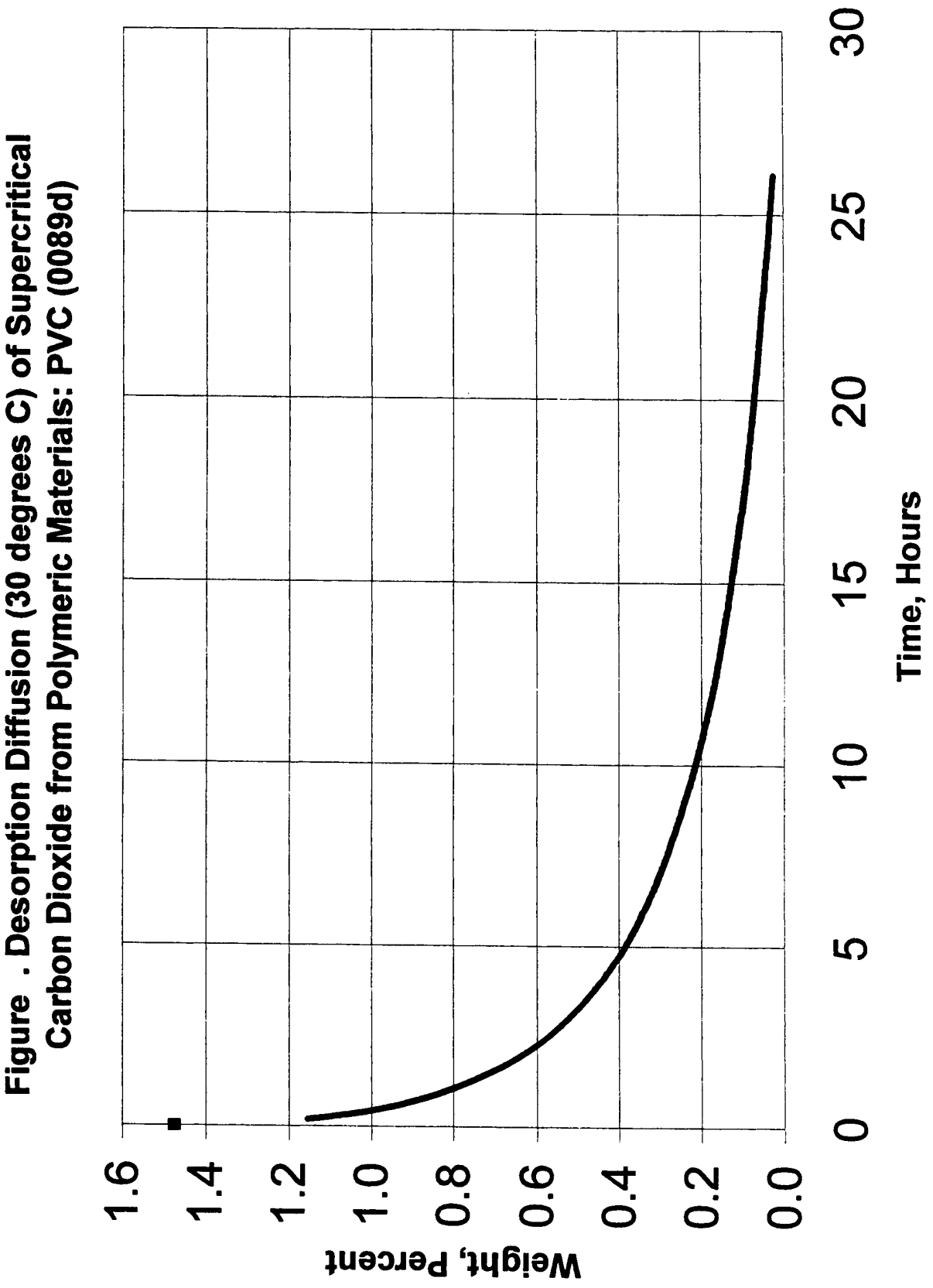


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PVC (0089d)
Weight, Percent
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30
Time, Hours

Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PVC (0089d)

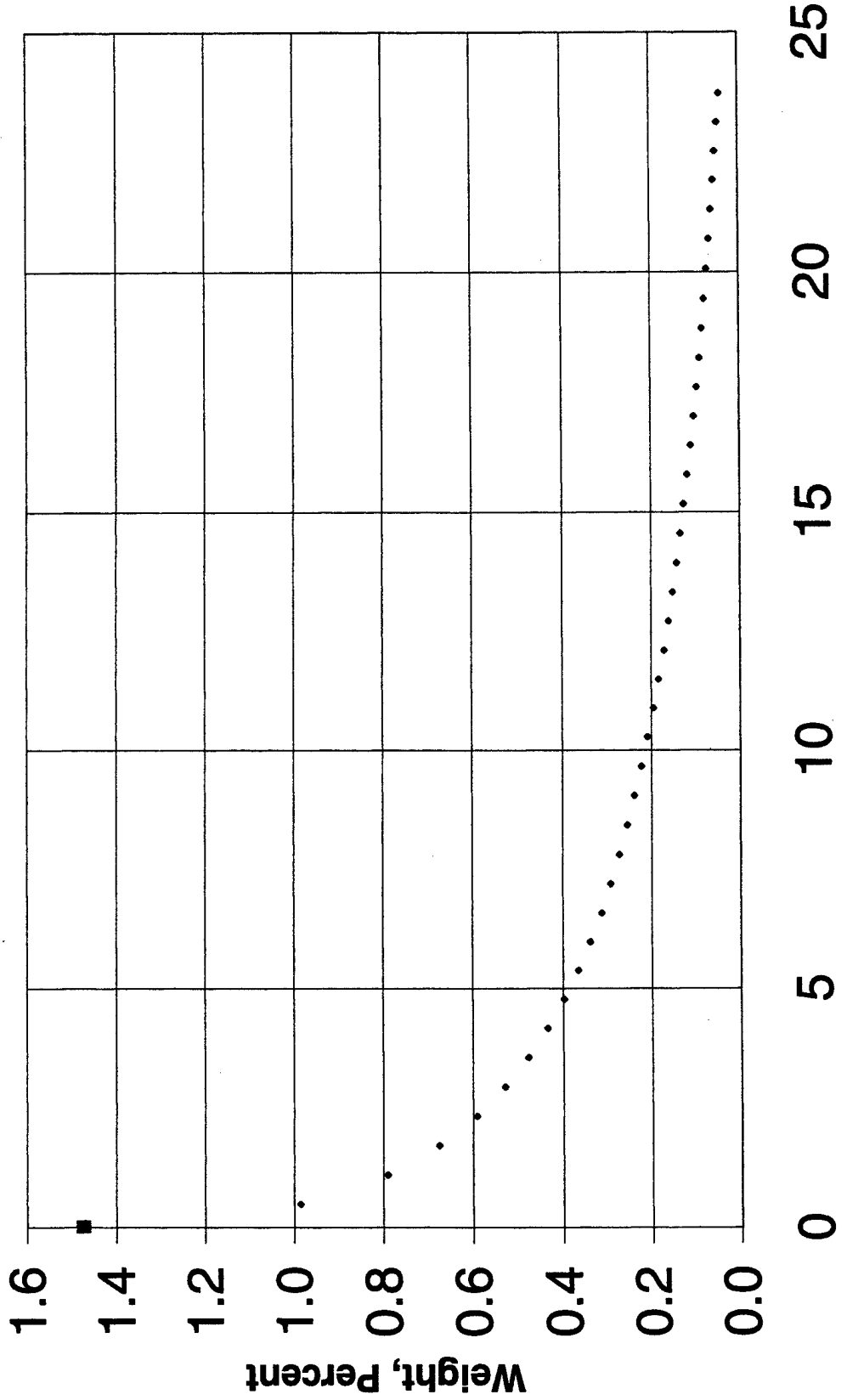
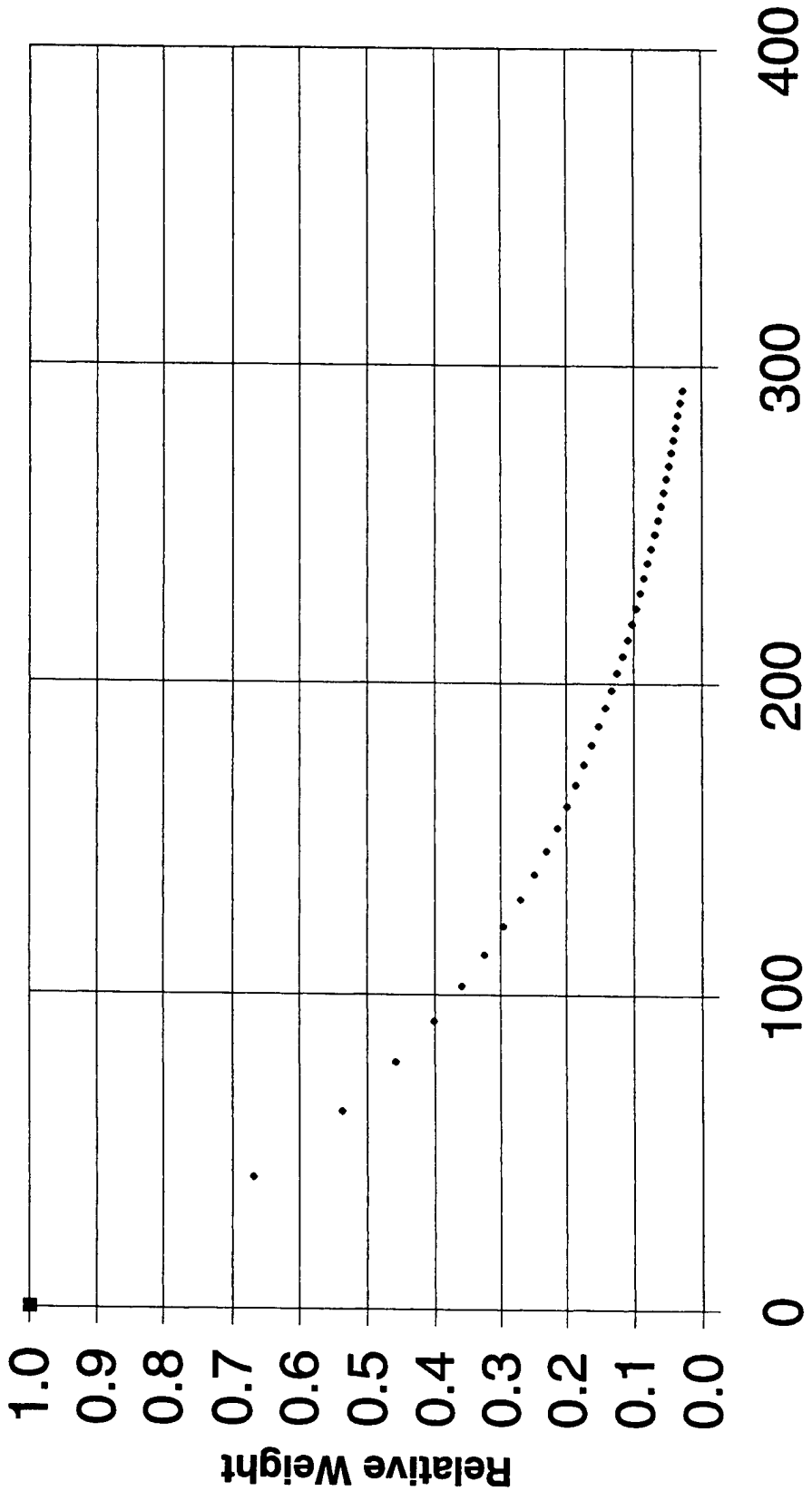


Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PVC (0089d)



TGA Time, min A	Temp., deg C B	TGA Wt., mg C	TGA Time, sec D	Adjusted Time, sec E	Adjusted Time, hr F	SQRT Adj. Time, sec G	Wt. Loss, % H	Fractional Wt. Loss I	Wt. @ Zero Time, mg J	Wt. @ Zero Time, % K	TGA Dry Wt., mg L	Adjustment to TGA Time, sec M	Hardness Scale N
18.250	30.026	106.287	1095.000	1755.000	0.488	41.89	0.986	0.669	106.80	1.474	105.249	660	Shore D
54.921	30.000	106.081	3295.260	3955.260	1.099	62.89	0.791	0.536					
91.612	30.000	105.960	5496.720	6156.720	1.710	78.46	0.676	0.458					Pre Exposure
128.295	30.000	105.872	7697.700	8357.700	2.322	91.42	0.592	0.402	Formulae Used for Analysis of Data				Hardness
164.970	30.000	105.806	9898.200	10558.200	2.933	102.75	0.529	0.359	Uppercase letters refer to columns				73.4
201.653	30.000	105.752	12099.180	12759.180	3.544	112.96	0.478	0.324	Lowercase n refers to row, beginning with n=4				
238.372	30.000	105.707	14302.320	14962.320	4.156	122.32	0.435	0.295	----------				Post Desorption
275.077	30.000	105.668	16504.620	17164.620	4.768	131.01	0.398	0.270	Dn = (An * 60)				Hardness
311.812	30.000	105.635	18708.720	19368.720	5.380	139.17	0.367	0.249	En = (Dn + M4)				71.5
348.518	30.000	105.606	20911.080	21571.080	5.992	146.87	0.339	0.230	Fn = (En / 3600)				
385.241	30.000	105.580	23114.460	23774.460	6.604	154.19	0.314	0.213	Gn = SQRT (En)				Change in
421.921	30.000	105.558	25315.260	25975.260	7.215	161.17	0.294	0.199	Hn = (((Cn - L4) / L4) * 100)				Hardness, %
458.658	30.000	105.537	27519.480	28179.480	7.828	167.87	0.274	0.186	In = ((Cn - L4) / (J4 - L4))				-2.59
495.375	30.000	105.518	29722.500	30382.500	8.440	174.31	0.256	0.173	K4 = (((J4 - L4) / L4) * 100)				
532.075	30.000	105.501	31924.500	32584.500	9.051	180.51	0.239	0.162	N16 = (((N12 - N8) / N8) * 100)				
568.747	30.000	105.484	34124.820	34784.820	9.662	186.51	0.223	0.152					
605.434	30.000	105.469	36326.040	36986.040	10.274	192.32	0.209	0.142					
642.127	30.001	105.455	38527.620	39187.620	10.885	197.96	0.196	0.133	Source binary TA data file : pvc0089d.01				
678.846	30.000	105.442	40730.760	41390.760	11.497	203.45	0.183	0.124	14 lines in the parameter block				
715.548	30.000	105.429	42932.880	43592.880	12.109	208.79	0.171	0.116	3 channels of data				
752.259	30.001	105.418	45135.540	45795.540	12.721	214.00	0.161	0.109	----------				
788.954	30.000	105.408	47337.240	47997.240	13.333	219.08	0.151	0.103	Run 23				
825.628	30.000	105.398	49537.680	50197.680	13.944	224.05	0.142	0.096	Module TGA Aluminum Pans				
862.321	30.000	105.389	51739.260	52399.260	14.555	228.91	0.133	0.090	Sample PVC SCCO2 0089D				
899.035	30.000	105.381	53942.100	54602.100	15.167	233.67	0.125	0.085	Size 106.469 mg				
935.722	30.000	105.372	56143.320	56803.320	15.779	238.33	0.117	0.079	Method DESORPTION-Isothermal				
972.398	30.000	105.364	58343.880	59003.880	16.390	242.91	0.109	0.074	Operator WJS				
1009.092	30.000	105.356	60545.520	61205.520	17.002	247.40	0.102	0.069	Comment Disk: .4x0.03 in. HP@1400x50 Dry Wt, TGA: 105.249 ET: 11:30				
1045.810	30.000	105.349	62748.600	63408.600	17.614	251.81	0.095	0.064	Nsig 3				
1082.522	30.000	105.342	64951.320	65611.320	18.225	256.15	0.088	0.060	Sig1 Time (min)				
1119.216	30.000	105.336	67152.960	67812.960	18.837	260.41	0.083	0.056	Sig2 Temperature (øC)				
1155.910	30.000	105.330	69354.600	70014.600	19.449	264.60	0.077	0.052	Sig3 Weight (mg)				
1192.602	30.000	105.324	71556.120	72216.120	20.060	268.73	0.071	0.048	Kcell 1.0000				
1229.303	30.000	105.318	73758.180	74418.180	20.672	272.80	0.066	0.044	Date 29-Mar-00				
1266.001	30.000	105.313	75960.060	76620.060	21.283	276.80	0.061	0.041	Time 14:01				
1302.711	30.000	105.308	78162.660	78822.660	21.895	280.75	0.056	0.038					
1339.419	30.000	105.303	80365.140	81025.140	22.507	284.65	0.051	0.035					
1376.127	30.000	105.298	82567.620	83227.620	23.119	288.49	0.047	0.032					
1412.846	30.000	105.292	84770.760	85430.760	23.731	292.29	0.041	0.028					

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FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Polyvinyl Chloride PVC

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	03-1-3	TGA Filename:	pvc0110z
Property Test Specification:	ASTM D471/D543		
Material Name:	Polyvinyl Chloride	Material Code:	PVC
Material Supplier:	Harbor City Plastics	Material Class:	TP
Monomer Source:	Georgia Gulf	Base Polymer (Lot. No.):	(4576T1)
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	3

Pre-Exposure Data

Measured Diameter (mm):	11.01	11	11.07	10.99	
Mean Diameter:	11.005		95% Confidence Level (CL):		0.057
Measured Thickness (mils):	42.60	43.00	41.90	41.10	
Mean Thickness:	42.150		95% Confidence Level (CL):		1.328
Initial Sample Weight (mg):	100.640				
Initial Durometer Hardness:	ND	Scale: SHORE	D		

Sample Exposure Data

Exposure Date:	04/19/00	Time:	08:37:00
Removal Date:	04/19/00	Time:	08:52:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	102.30
Weight Gain (mg):	1.66	Percent Weight Gain:	1.65
Final Durometer Hardness After Desorption:	ND	Percent Hardness Change:	ND

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.000	95% CL:	0.0007
Time Lapse Between Sample Exposure and Sample Desorption (sec):			450
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			100.660
Sample Extracted (mg):	-0.02	Solubility Corrected for Extractables (mg):	1.66
Sample Extracted (%):	-0.02	Solubility Corrected for Extractables (%):	1.65

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm2/sec):			1.2995E-07
Range Including 0,1 Intercept, Relative Weight Fraction:			1.00 - 0.70
Linear Range of Desorption, Relative Weight Fraction:			0.83 - 0.70
Slope:	-7.5987E-03	X-axis Intercept:	1.3033E+02
R Square:	0.99801	Y-axis Intercept:	9.9033E-01

Low Concentration Diffusion Coefficient (cm2/sec):			3.2042E-10
Linear Range of Desorption, Relative Weight Fraction:			0.06 - 0.01
Slope:	-3.7732E-04	X-axis Intercept:	4.6480E+02
R Square:	0.99010	Y-axis Intercept:	1.7538E-01

Wt. @ Zero Time, mg K 102.30	Wt. @ Zero Time, % L 1.649	Adjustment to TGA Time, sec M 450	Hardness Shore Scale N D
TGA Dry Wt., mg 100.640	Equil. Wt. Of Desorb. Sample 100.66	Min. Wt. Used For FDC, mg. 100.640	Pre Exposure Hardness ND
High Conc. DC, cm2/sec 1.2995E-07	Low Conc. DC, cm2/sec 3.2042E-10	Total Liquid Sorbed, mg. 1.660	Post Desorption Hardness ND
R Square 0.99801	R Square 0.99010		Change in Hardness, % ND
X Intercept 130.33	X Intercept 464.8		Mean Thickness, cm. 0.1071
Y Intercept 0.99033	Y Intercept 0.17538		**pvc0110z**
Y Intercept as Wt., mg. 101.310	X Intercept as Time, hrs. 60.0	X Intercept as Time, min. 360.1	X Intercept as Time, days 2.5
		Max. TGA Wt., (orig data file) 102.014	TGA Wt. At 20 min. Adjustment 101.848
		Sorption @ 7-12 min., mg 1.37	Sorption @ 20 min., mg 1.21
		Sorption @ 7-12 min., % 1.37	Sorption @ 20 min., % 1.20
		Rel. Error (%) of 7-12 min. Sorp. -17.2	Rel. Error (%) of 20 min. Sorp -27.2

TEMPERATURE STATISTICS

Column1	
Mean	30.0000917
Standard Error	0.000342257
Median	30
Mode	30
Standard Deviation	0.020155416
Sample Variance	0.000406241
Kurtosis	596.0945094
Skewness	-16.45057779
Range	0.948
Minimum	29.291
Maximum	30.239
Sum	104040.318
Count	3468
Confidence Level(95.0%)	0.000671045

DIAMETER STATISTICS

	Column1	
	Mean	11.0175
	Standard Error	0.01796988
	Median	11.005
	Mode	#N/A
	Standard Deviation	0.03593976
	Sample Variance	0.00129167
	Kurtosis	3.01436004
	Skewness	1.6963868
	Range	0.08
	Minimum	10.99
	Maximum	11.07
ND/value	Sum	44.07
ND/value	Count	4
A/D	Confidence Level(95.0%)	0.05718824

THICKNESS STATISTICS

	Column1	
	Mean	42.15
	Standard Error	0.4173328
	Median	42.25
	Mode	#N/A
	Standard Deviation	0.8346656
	Sample Variance	0.69666667
	Kurtosis	-1.2583503
(4576T1)	Skewness	-0.5365585
pvc0110z	Range	1.9
	Minimum	41.1
	Maximum	43
	Sum	168.6
	Count	4
	Confidence Level(95.0%)	1.32814048

HIGH CONCENTRATION DIFFUSION COEFFICIENT

pvc0110z

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999006486
R Square	0.998013959
Adjusted R Square	0.997957215
Standard Error	0.002478215
Observations	37

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.108017579	0.108017579	17587.9965	6.95037E-49
Residual	35	0.000214954	6.14155E-06		
Total	36	0.108232533			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.990325638	0.001773751	558.3229407	1.0143E-70	0.986724729	0.993926548
X Variable 1	-0.007598731	5.72971E-05	-132.6197438	6.9504E-49	-0.00771505	-0.007482411

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

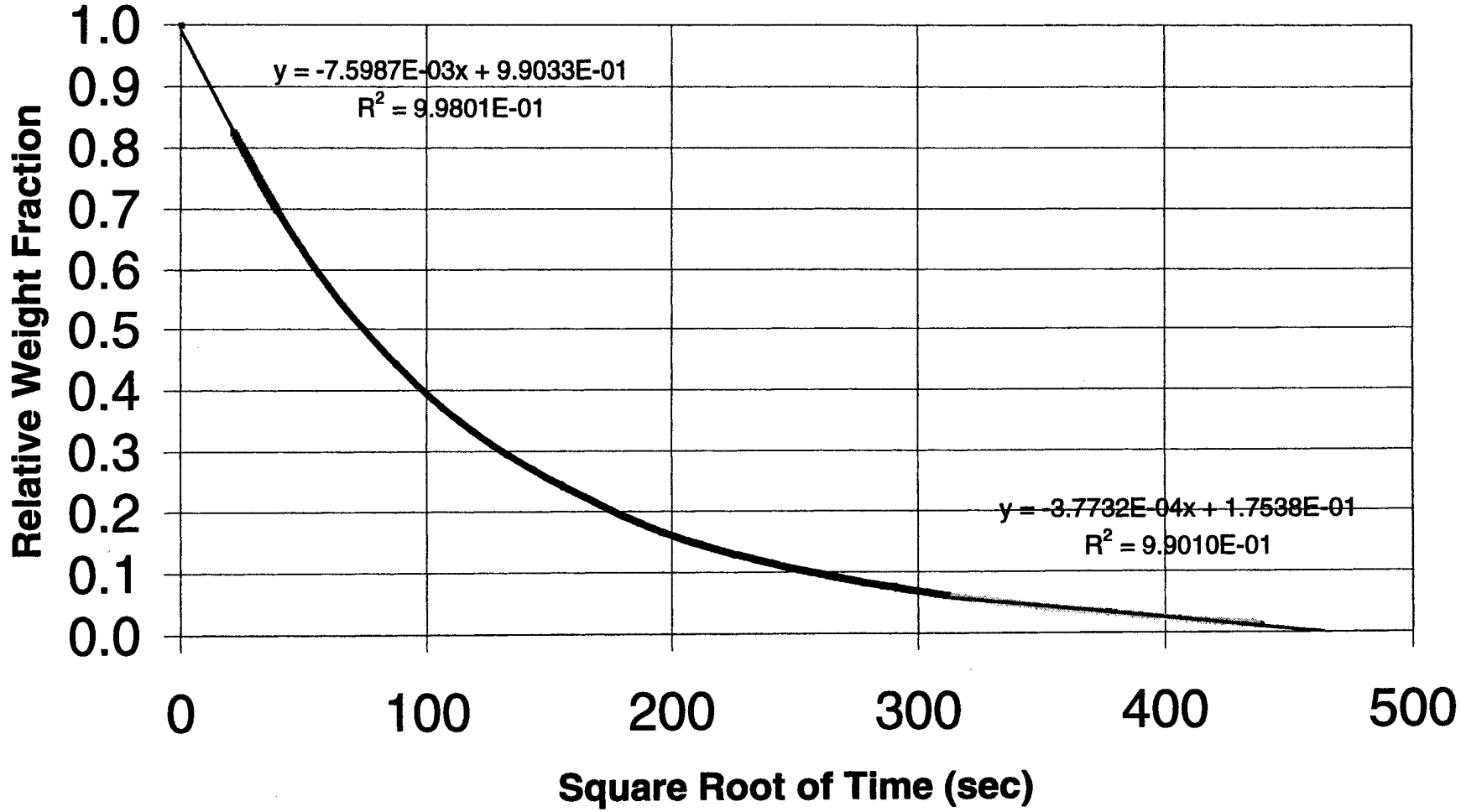
Regression Statistics	
Multiple R	0.995040016
R Square	0.990104633
Adjusted R Square	0.990085785
Standard Error	0.001369069
Observations	527

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.098459911	0.098459911	52530.1336	0
Residual	525	0.000984034	1.87435E-06		
Total	526	0.099443945			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.175377777	0.000627973	279.2759937	0	0.17414413	0.176611424
X Variable 1	-0.000377322	1.6463E-06	-229.1945321	0	-0.000380556	-0.000374088

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PVC (0110z)



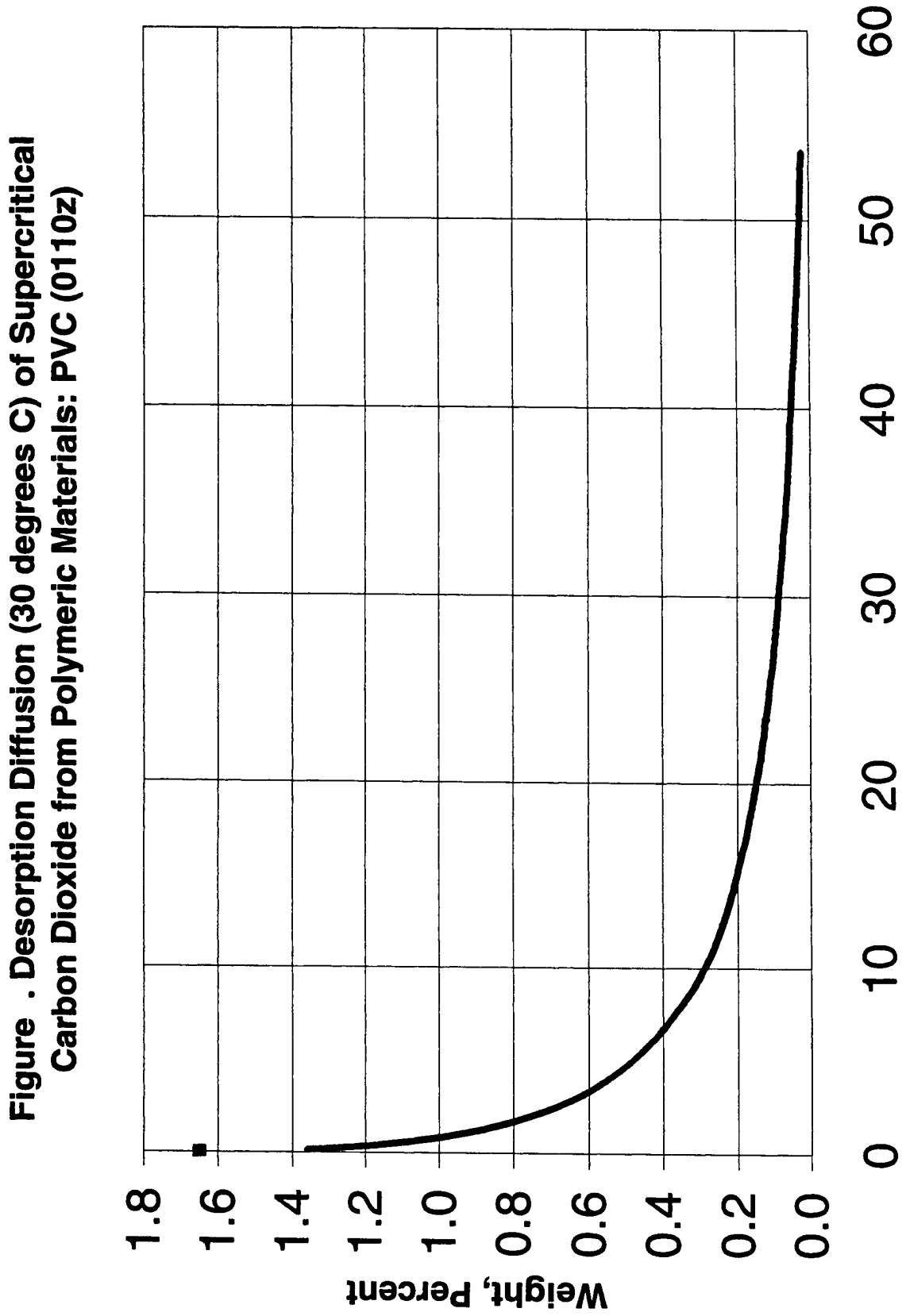


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PVC (0110z)
Weight, Percent
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
10
20
30
40
50
60
Time, Hours

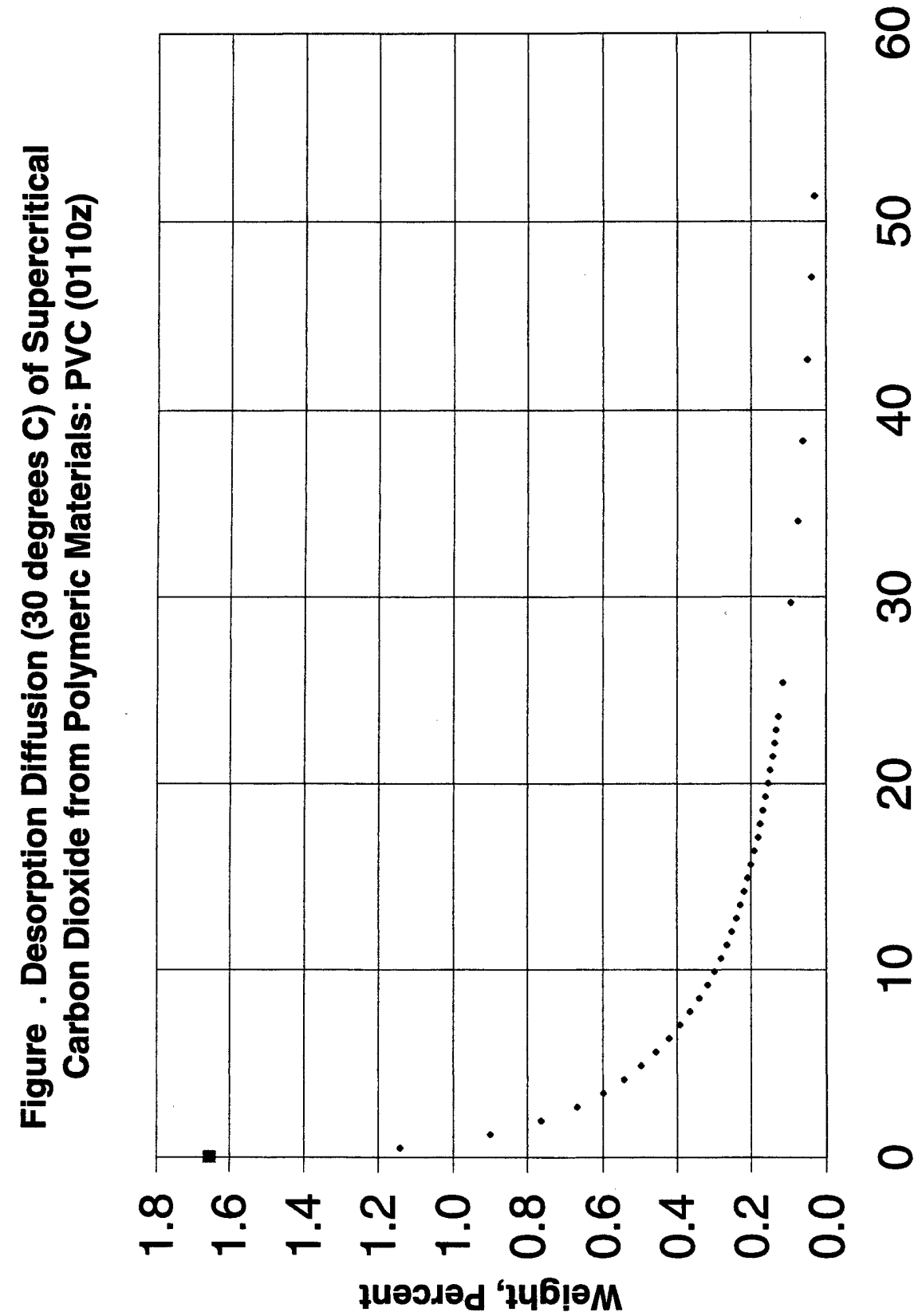
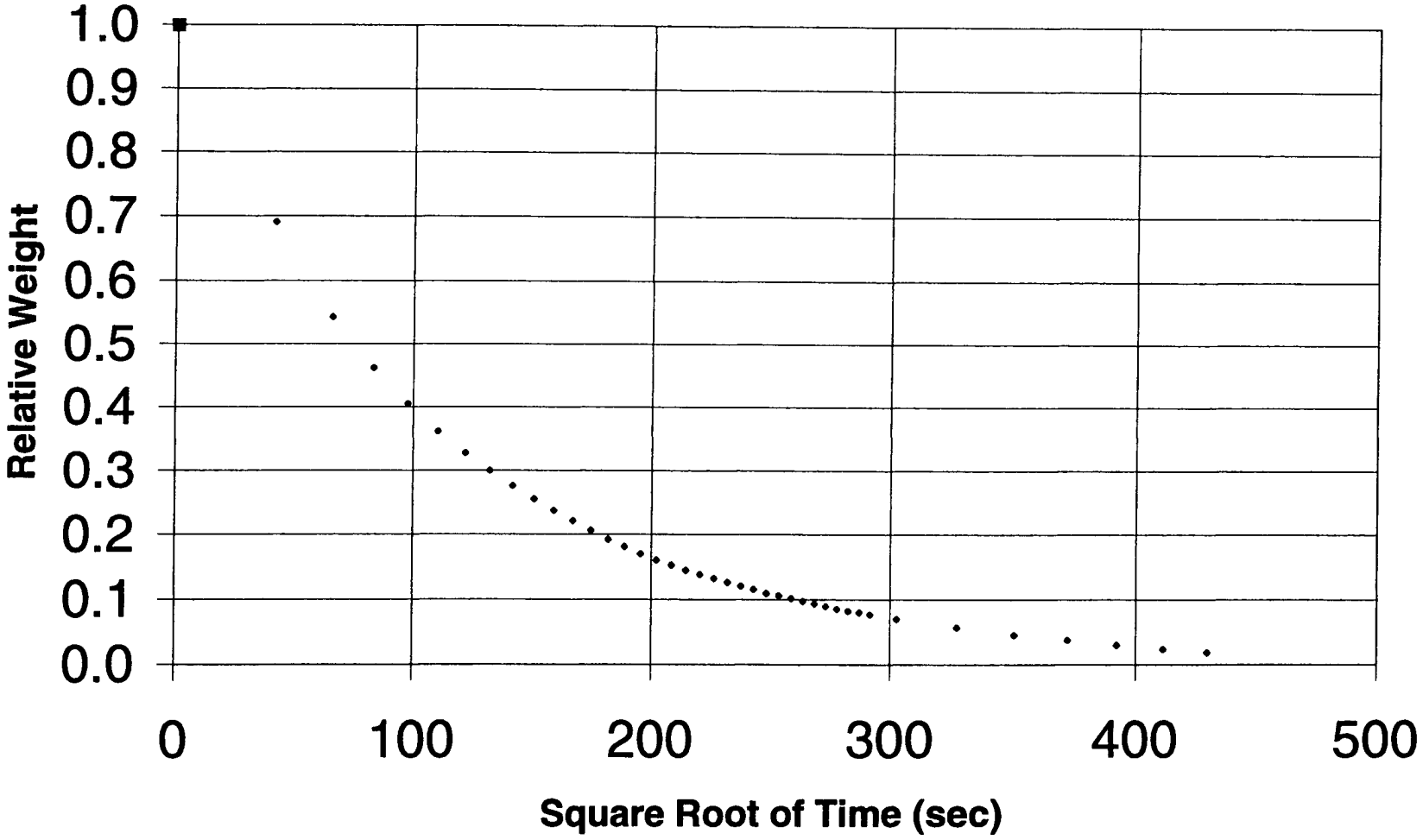


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PVC (0110z)

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PVC (0110z)



TGA Time, min	Temp., deg C	TGA Wt., mg	TGA Time, sec	Adjusted Time, sec	Adjusted Time, hr	SQRT Adj. Time, sec	Wt. Loss, %	Fractional Wt. Loss	Wt. @ Zero Time, mg	Wt. @ Zero Time, %	TGA Dry Wt., mg	Adjustment to TGA Time, sec	Hardness Scale
A	B	C	D	E	F	G	H	I	J	K	L	M	N
21.583	29.998	101.785	1294.980	1744.980	0.485	41.77	1.143	0.691	102.30	1.654	100.635	450	Shore D
64.916	30.000	101.540	3894.960	4344.960	1.207	65.92	0.899	0.544					
108.255	30.000	101.404	6495.300	6945.300	1.929	83.34	0.764	0.462					
151.603	30.000	101.309	9096.180	9546.180	2.652	97.70	0.670	0.405					
195.067	30.000	101.238	11704.020	12154.020	3.376	110.25	0.599	0.362					
238.458	30.000	101.181	14307.480	14757.480	4.099	121.48	0.543	0.328					
281.835	30.000	101.134	16910.100	17360.100	4.822	131.76	0.496	0.300					
325.213	30.000	101.094	19512.780	19962.780	5.545	141.29	0.456	0.276					
368.638	30.000	101.059	22118.280	22568.280	6.269	150.23	0.421	0.255					
412.093	30.000	101.030	24725.580	25175.580	6.993	158.67	0.393	0.237					
455.530	30.000	101.003	27331.800	27781.800	7.717	166.68	0.366	0.221					
498.926	30.000	100.978	29935.560	30385.560	8.440	174.31	0.341	0.206					
542.294	30.000	100.955	32537.640	32987.640	9.163	181.62	0.318	0.192					
585.684	30.000	100.936	35141.040	35591.040	9.886	188.66	0.299	0.181					
629.093	30.001	100.918	37745.580	38195.580	10.610	195.44	0.281	0.170					
672.489	30.001	100.902	40349.340	40799.340	11.333	201.99	0.265	0.160					
715.862	30.000	100.889	42951.720	43401.720	12.056	208.33	0.252	0.153					
759.199	30.000	100.876	45551.940	46001.940	12.778	214.48	0.239	0.145					
802.569	30.000	100.865	48154.140	48604.140	13.501	220.46	0.229	0.138					
846.006	30.000	100.855	50760.360	51210.360	14.225	226.30	0.219	0.132					
889.404	30.000	100.845	53364.240	53814.240	14.948	231.98	0.209	0.126					
932.792	30.000	100.836	55967.520	56417.520	15.672	237.52	0.200	0.121					
976.171	30.000	100.827	58570.260	59020.260	16.395	242.94	0.191	0.115					
1019.537	30.000	100.817	61172.220	61622.220	17.117	248.24	0.181	0.109					
1062.936	30.000	100.811	63776.160	64226.160	17.841	253.43	0.175	0.106					
1106.294	30.000	100.804	66377.640	66827.640	18.563	258.51	0.168	0.102					
1149.658	30.000	100.797	68979.480	69429.480	19.286	263.49	0.161	0.097					
1193.003	30.000	100.790	71580.180	72030.180	20.008	268.38	0.154	0.093					
1236.350	30.000	100.784	74181.000	74631.000	20.731	273.19	0.148	0.089					
1279.745	30.000	100.777	76784.700	77234.700	21.454	277.91	0.141	0.085					
1323.091	30.000	100.772	79385.460	79835.460	22.177	282.55	0.136	0.082					
1366.445	30.000	100.768	81986.700	82436.700	22.899	287.12	0.132	0.080					
1409.801	30.001	100.762	84588.060	85038.060	23.622	291.61	0.126	0.076					
1519.198	30.000	100.751	91151.880	91601.880	25.445	302.66	0.115	0.070					
1773.999	30.000	100.729	106439.940	106889.940	29.692	326.94	0.093	0.056					
2034.000	30.000	100.710	122040.000	122490.000	34.025	349.99	0.075	0.045					
2294.001	30.000	100.697	137640.060	138090.060	38.358	371.60	0.062	0.037					
2554.020	30.000	100.684	153241.200	153691.200	42.692	392.03	0.049	0.029					
2814.018	30.000	100.673	168841.080	169291.080	47.025	411.45	0.038	0.023					
3074.020	30.000	100.665	184441.200	184891.200	51.359	429.99	0.030	0.018					

Formulae Used for Analysis of Data
Uppercase letters refer to columns
Lowercase n refers to row, beginning with n=4

Dn = (An * 60)
En = (Dn + M4)
Fn = (En / 3600)
Gn = SQRT (En)
Hn = (((Cn - L4) / L4) * 100)
In = ((Cn - L4) / (J4 - L4))
K4 = (((J4 - L4) / L4) * 100)
N16 = (((N12 – N8) /N8) * 100)

Source binary TA data file : pvc0110z.01
14 lines in the parameter block
3 channels of data

Run 30
Module TGA Aluminum Pans
Sample PVC SCO2 PVC0110Z
Size 102.014 mg
Method DESORPTION-Isothermal
Operator WJS
Comment Disk: .4x0.03 in., HP@1400x50, Dry: M-100.69 TG-100.635 ET-7:30
Nsig 3
Sig1 Time (min)
Sig2 Temperature (øC)
Sig3 Weight (mg)
Kcell 1.0000
Date 19-Apr-00
Time 09:00

Pre Exposure Hardness	Post Desorption Hardness	Change in Hardness, %
ND	ND	#VALUE!

Blank

FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Polyimide PIF

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	15-1-1	TGA Filename:	pif0151z
Property Test Specification:	ASTM D471/D543		
Material Name:	Polyimide	Material Code:	PIF
Material Supplier:	Goodfellow Cambridge Ltd.	Material Class:	Blank
Monomer Source:	Unknown	Base Polymer (Lot. No.):	Upilex
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	1

Pre-Exposure Data

Measured Diameter (mm):	8.42	8.42	8.55	8.44	
Mean Diameter:	8.430		95% Confidence Level (CL):		0.099
Measured Thickness (mils):	10.00	11.90	11.00	10.30	
Mean Thickness:	10.800		95% Confidence Level (CL):		1.344
Initial Sample Weight (mg):	19.260				
Initial Durometer Hardness:	82.5	Scale: SHORE	D		

Sample Exposure Data

Exposure Date:	05/30/00	Time:	10:55:00
Removal Date:	05/30/00	Time:	11:10:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	19.30
Weight Gain (mg):	0.04	Percent Weight Gain:	0.21
Final Durometer Hardness After Desorption:	82.2	Percent Hardness Change:	-0.4

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.001	95% CL:	0.0005
Time Lapse Between Sample Exposure and Sample Desorption (sec):			430
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			19.090
Sample Extracted (mg):	0.17	Solubility Corrected for Extractables (mg):	0.21
Sample Extracted (%):	0.88	Solubility Corrected for Extractables (%):	1.09

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm2/sec):			1.8434E-09
Range Including 0,1 Intercept, Relative Weight Fraction:			1.00 - 0.90
Linear Range of Desorption, Relative Weight Fraction:			0.95 - 0.90
Slope:	-3.5321E-03	X-axis Intercept:	2.8530E+02
R Square:	0.86086	Y-axis Intercept:	1.0077E+00

Low Concentration Diffusion Coefficient (cm2/sec):			1.1647E-10
Linear Range of Desorption, Relative Weight Fraction:			0.05 - 0.00
Slope:	-8.8786E-04	X-axis Intercept:	4.0875E+02
R Square:	0.99548	Y-axis Intercept:	3.6291E-01

Wt. @ Zero Time, mg K 19.30	Wt. @ Zero Time, % L 0.208	Adjustment to TGA Time, sec M 430	Hardness Shore Scale N D
TGA Dry Wt., mg 19.260	Equil. Wt. Of Desorb. Sample 19.09	Min. Wt. Used For FDC, mg. 19.090	Pre Exposure Hardness 82.5
High Conc. DC, cm2/sec 1.8434E-09	Low Conc. DC, cm2/sec 1.1647E-10	Total Liquid Sorbed, mg. 0.040	Post Desorption Hardness 82.2
R Square 0.86086	R Square 0.99548		Change in Hardness, % -0.4
X Intercept 285.30	X Intercept 408.7		Mean Thickness, cm. 0.0274
Y Intercept 1.00772	Y Intercept 0.36291		**pif0151z**
Y Intercept as Wt., mg. 19.449	X Intercept as Time, hrs. 46.4	X Intercept as Time, min. 278.5	X Intercept as Time, days 1.9
		Max. TGA Wt., (orig data file) 19.291	TGA Wt. At 20 min. Adjustment 19.268
		Sorption @ 7-12 min., mg 0.03	Sorption @ 20 min., mg 0.01
		Sorption @ 7-12 min., % 0.16	Sorption @ 20 min., % 0.04
		Rel. Error (%) of 7-12 min. Sorp. -22.5	Rel. Error (%) of 20 min. Sorp -80.0

TEMPERATURE STATISTICS

Column1	
Mean	30.00114585
Standard Error	0.00026329
Median	30.001
Mode	29.998
Standard Deviation	0.015213991
Sample Variance	0.000231466
Kurtosis	693.6462665
Skewness	-20.3095439
Range	0.676
Minimum	29.428
Maximum	30.104
Sum	100173.826
Count	3339
Confidence Level(95.0%)	0.000516227

DIAMETER STATISTICS

	Column1	
	Mean	8.4575
	Standard Error	0.03119161
	Median	8.43
	Mode	8.42
	Standard Deviation	0.06238322
	Sample Variance	0.00389167
	Kurtosis	3.50405568
	Skewness	1.86901672
	Range	0.13
	Minimum	8.42
	Maximum	8.55
ND/value	Sum	33.83
ND/value	Count	4
A/D	Confidence Level(95.0%)	0.09926572

THICKNESS STATISTICS

	Column1	
	Mean	10.8
	Standard Error	0.42229532
	Median	10.65
	Mode	#N/A
	Standard Deviation	0.84459063
	Sample Variance	0.71333333
	Kurtosis	-0.8058782
Upilex	Skewness	0.77679617
pif0151z	Range	1.9
	Minimum	10
	Maximum	11.9
	Sum	43.2
	Count	4
	Confidence Level(95.0%)	1.34393343

HIGH CONCENTRATION DIFFUSION COEFFICIENT

pif0151z

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.927826825
R Square	0.860862618
Adjusted R Square	0.845402909
Standard Error	0.011130957
Observations	11

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.006899181	0.006899181	55.68427	3.84247E-05
Residual	9	0.001115084	0.000123898		
Total	10	0.008014265			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	1.00772173	0.010826876	93.07594323	9.6714E-15	0.983229616	1.032213845
X Variable 1	-0.00353209	0.000473332	-7.462189357	3.8425E-05	-0.004602842	-0.002461339

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

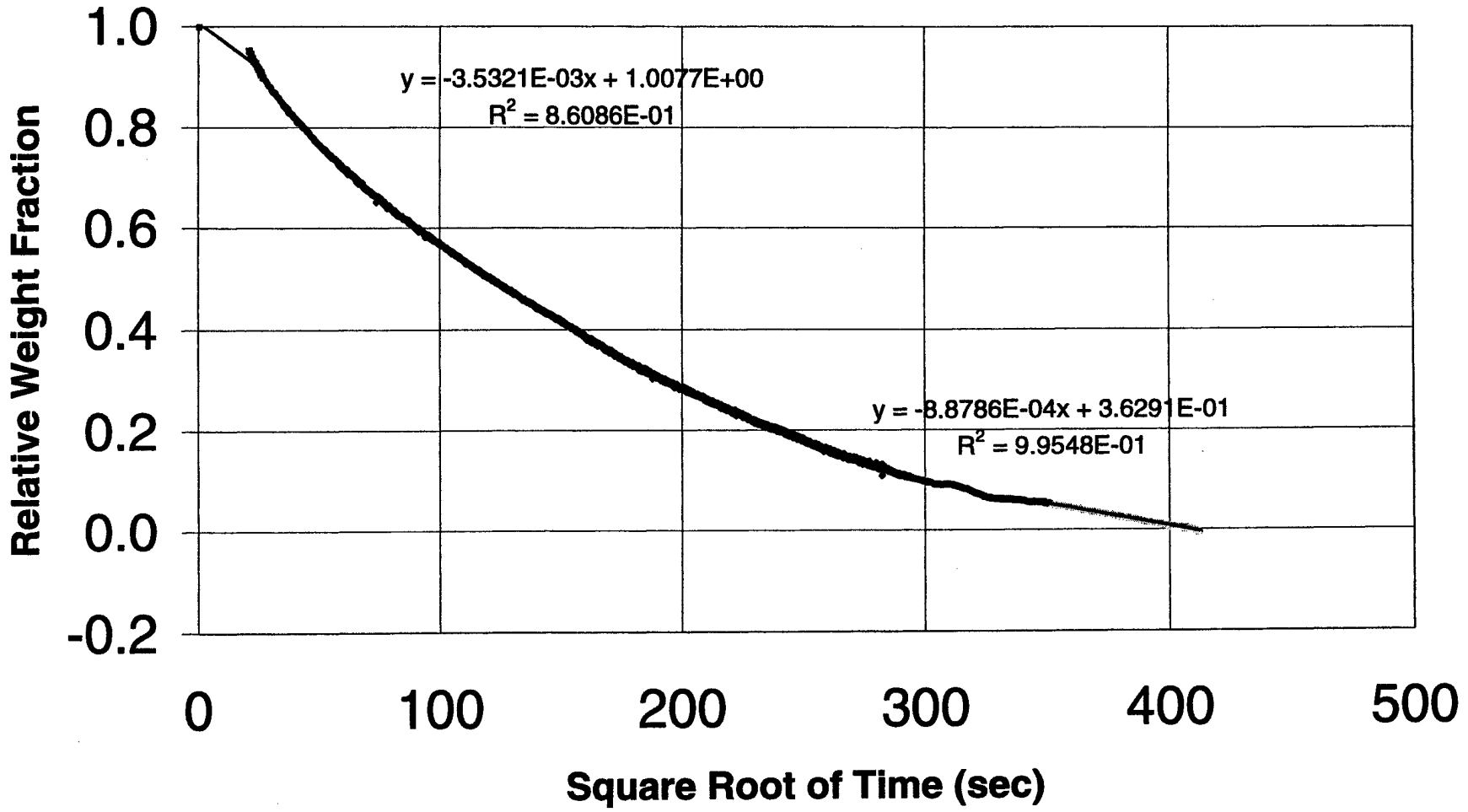
Regression Statistics	
Multiple R	0.997739896
R Square	0.9954849
Adjusted R Square	0.995467263
Standard Error	0.001053154
Observations	258

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.062602448	0.062602448	56442.6332	3.1318E-302
Residual	256	0.000283938	1.10913E-06		
Total	257	0.062886387			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.36290949	0.001430813	253.6386217	0	0.360091826	0.365727153
X Variable 1	-0.000887858	3.73714E-06	-237.5765839	3.132E-302	-0.000895217	-0.000880498

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PIF (0151z)



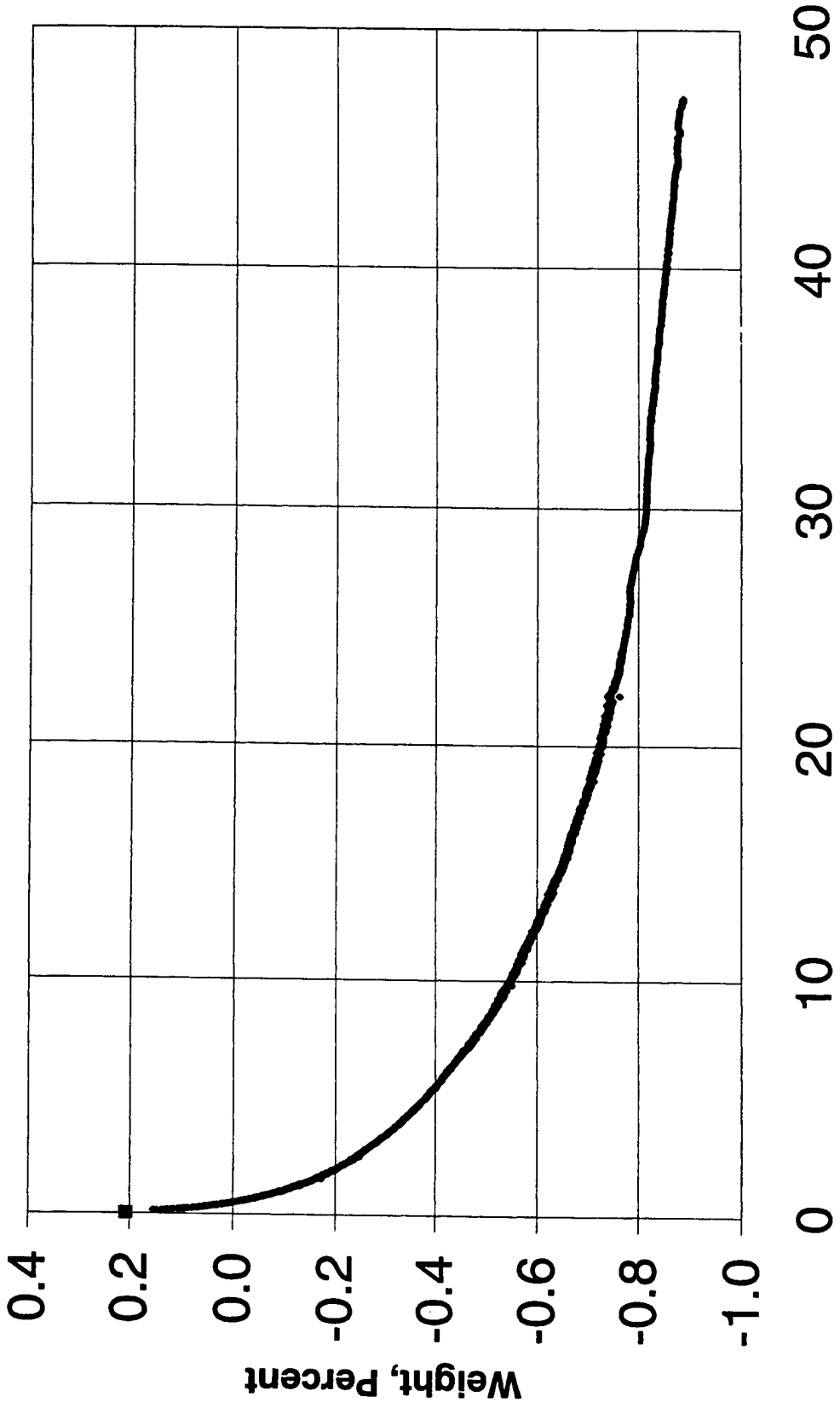
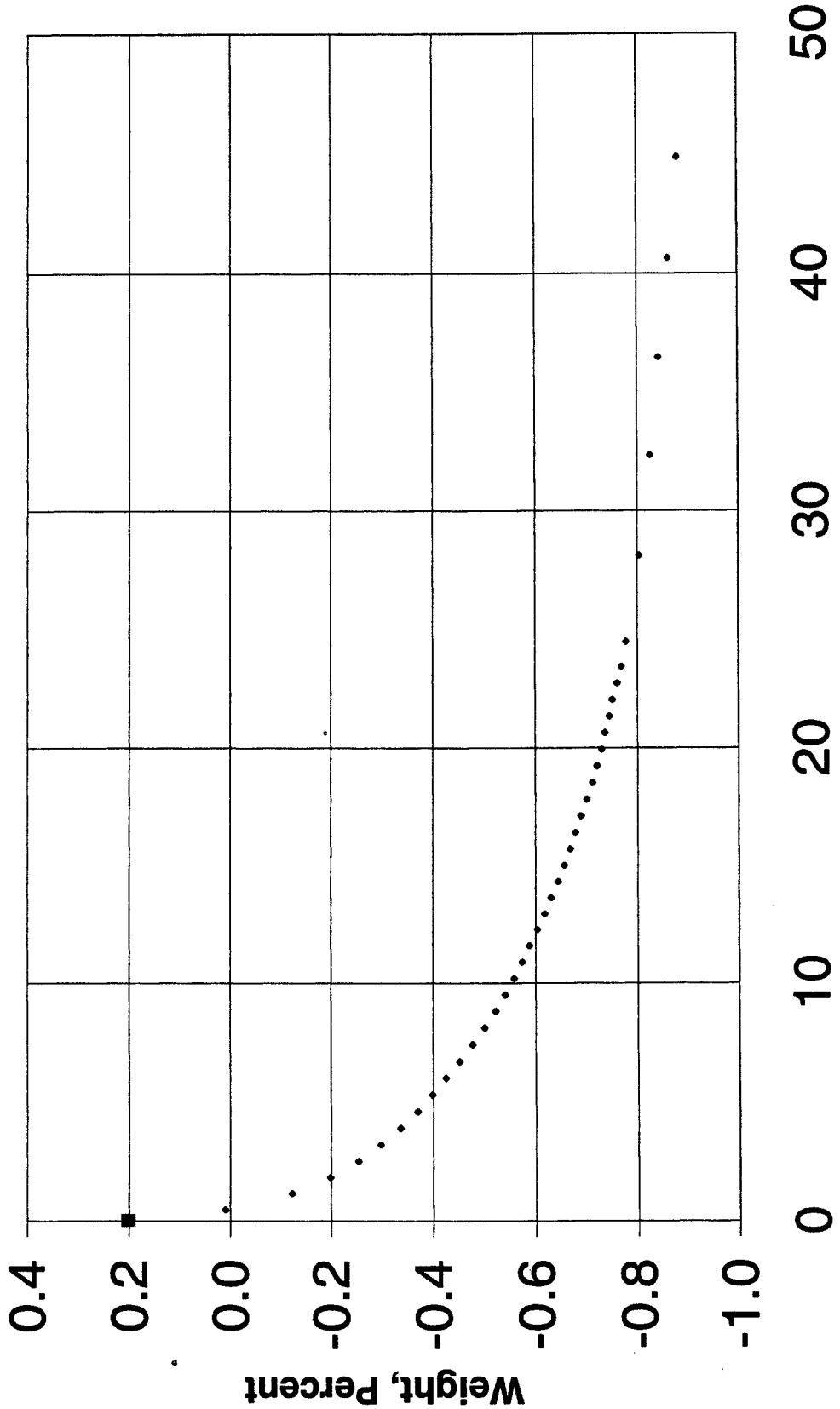


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PIF (0151z)

Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PIF (0151z)



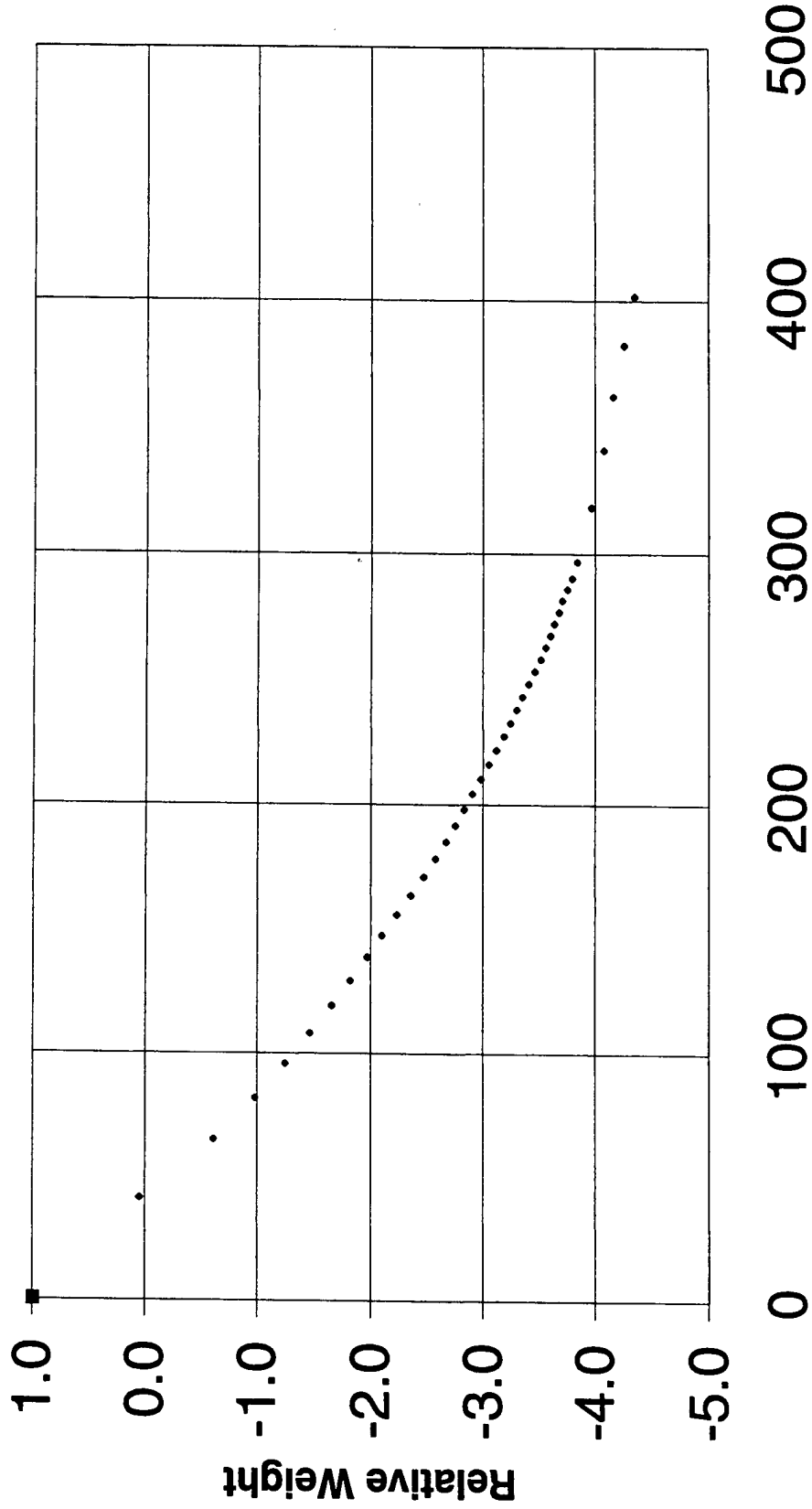


Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PIF (0151z)

TGA Time, min A	Temp., deg C B	TGA Wt., mg C	TGA Time, sec D	Adjusted Time, sec E	Adjusted Time, hr F	SQRT Adj. Time, sec G	Wt. Loss, % H	Fractional Wt. Loss I	Wt. @ Zero Time, mg J	Wt. @ Zero Time, % K	TGA Dry Wt., mg L	Adjustment to TGA Time, sec M	Hardness Scale N
20.796	29.992	19.263	1247.760	1677.760	0.466	40.96	0.010	0.049	19.30	0.202	19.261	430	Shore D
62.516	30.002	19.237	3750.960	4180.960	1.161	64.66	-0.123	-0.608					
104.189	30.000	19.223	6251.340	6681.340	1.856	81.74	-0.198	-0.979					Pre Exposure
145.869	30.001	19.212	8752.140	9182.140	2.551	95.82	-0.253	-1.249	Formulae Used for Analysis of Data				Hardness
187.557	30.001	19.204	11253.420	11683.420	3.245	108.09	-0.297	-1.467	Uppercase letters refer to columns				82.5
229.275	30.003	19.196	13756.500	14186.500	3.941	119.11	-0.336	-1.659	Lowercase n refers to row, beginning with n=4				
270.956	30.002	19.190	16257.360	16687.360	4.635	129.18	-0.369	-1.823	----------				Post Desorption
312.682	30.000	19.184	18760.920	19190.920	5.331	138.53	-0.399	-1.969	Dn = (An * 60)				Hardness
354.393	30.001	19.179	21263.580	21693.580	6.026	147.29	-0.425	-2.100	En = (Dn + M4)				82.2
396.099	30.002	19.174	23765.940	24195.940	6.721	155.55	-0.452	-2.231	Fn = (En / 3600)				
437.823	30.002	19.169	26269.380	26699.380	7.416	163.40	-0.477	-2.356	Gn = SQRT (En)				Change in
479.574	30.003	19.165	28774.440	29204.440	8.112	170.89	-0.500	-2.472	Hn = (((Cn - L4) / L4) * 100)				Hardness, %
521.303	30.002	19.161	31278.180	31708.180	8.808	178.07	-0.522	-2.577	In = ((Cn - L4) / (J4 - L4))				-0.36
563.065	30.002	19.157	33783.900	34213.900	9.504	184.97	-0.540	-2.669	K4 = (((J4 - L4) / L4) * 100)				
604.799	30.000	19.154	36287.940	36717.940	10.199	191.62	-0.558	-2.754	N16 = (((N12 – N8) /N8) * 100)				
646.496	30.002	19.151	38789.760	39219.760	10.894	198.04	-0.573	-2.831					
688.184	30.002	19.148	41291.040	41721.040	11.589	204.26	-0.588	-2.903					
729.891	30.002	19.145	43793.460	44223.460	12.284	210.29	-0.603	-2.979	Source binary TA data file : pif0151z.01				
771.613	30.002	19.142	46296.780	46726.780	12.980	216.16	-0.618	-3.051	14 lines in the parameter block				
813.384	30.002	19.140	48803.040	49233.040	13.676	221.89	-0.631	-3.115	3 channels of data				
855.113	30.001	19.137	51306.780	51736.780	14.371	227.46	-0.644	-3.182	----------				
896.833	30.001	19.135	53809.980	54239.980	15.067	232.89	-0.657	-3.244	Run 46				
938.553	30.002	19.132	56313.180	56743.180	15.762	238.21	-0.668	-3.297	Module TGA Aluminum Pans				
980.277	30.001	19.130	58816.620	59246.620	16.457	243.41	-0.678	-3.349	Sample PIF Polyimide Film 0151Z				
1022.013	30.002	19.128	61320.780	61750.780	17.153	248.50	-0.689	-3.403	Size 19.291 mg				
1063.747	30.000	19.126	63824.820	64254.820	17.849	253.49	-0.700	-3.459	Method DESORPTION-Isothermal				
1105.466	30.001	19.124	66327.960	66757.960	18.544	258.38	-0.711	-3.513	Operator bsi				
1147.171	30.000	19.122	68830.260	69260.260	19.239	263.17	-0.720	-3.556	Comment .336"x.012", HP15@1400 Dry: M-19.36 TGA-19.261 ET: 7:10				
1188.895	30.000	19.121	71333.700	71763.700	19.934	267.89	-0.729	-3.600	Nsig 3				
1230.615	30.000	19.119	73836.900	74266.900	20.630	272.52	-0.736	-3.633	Sig1 Time (min)				
1272.314	30.000	19.118	76338.840	76768.840	21.325	277.07	-0.744	-3.674	Sig2 Temperature (øC)				
1314.042	30.005	19.117	78842.520	79272.520	22.020	281.55	-0.750	-3.705	Sig3 Weight (mg)				
1355.781	30.002	19.115	81346.860	81776.860	22.716	285.97	-0.760	-3.751	Kcell 1.0000				
1397.511	30.002	19.113	83850.660	84280.660	23.411	290.31	-0.768	-3.792	Date 30-May-00				
1461.253	30.001	19.111	87675.180	88105.180	24.474	296.83	-0.777	-3.838	Time 11:18				
1680.891	30.002	19.106	100853.460	101283.460	28.134	318.25	-0.803	-3.967					
1930.898	30.002	19.102	115853.880	116283.880	32.301	341.00	-0.826	-4.077					
2180.899	30.002	19.099	130853.940	131283.940	36.468	362.33	-0.843	-4.162					
2430.897	30.002	19.095	145853.820	146283.820	40.634	382.47	-0.862	-4.259					
2680.898	30.002	19.091	160853.880	161283.880	44.801	401.60	-0.881	-4.349					

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FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Acrylonitrile-butadiene-styrene ABS

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	05-1-1	TGA Filename:	abs0115d
Property Test Specification:	ASTM D471/D543		
Material Name:	Acrylonitrile-butadiene-styrene	Material Code:	ABS
Material Supplier:	Goodfellow	Material Class:	TP
Monomer Source:	Unknown	Base Polymer (Lot. No.):	Unknown
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	1

Pre-Exposure Data

Measured Diameter (mm):	10.48	10.65	10.32	10.51	
Mean Diameter:	10.495		95% Confidence Level (CL):		0.215
Measured Thickness (mils):	65.60	62.00	61.40	59.70	
Mean Thickness:	62.175		95% Confidence Level (CL):		3.950
Initial Sample Weight (mg):	138.450				
Initial Durometer Hardness:	72.6	Scale: SHORE		D	

Sample Exposure Data

Exposure Date:	04/24/00	Time:	14:57:00
Removal Date:	04/24/00	Time:	15:12:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	143.60
Weight Gain (mg):	5.15	Percent Weight Gain:	3.72
Final Durometer Hardness After Desorption:	73.4	Percent Hardness Change:	1.1

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.000	95% CL:	0.0009
Time Lapse Between Sample Exposure and Sample Desorption (sec):			495
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			138.410
Sample Extracted (mg):	0.04	Solubility Corrected for Extractables (mg):	5.19
Sample Extracted (%):	0.03	Solubility Corrected for Extractables (%):	3.75

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm2/sec):			5.2834E-07
Range Including 0,1 Intercept, Relative Weight Fraction:			1.00 - 0.63
Linear Range of Desorption, Relative Weight Fraction:			0.77 - 0.63
Slope:	-1.0387E-02	X-axis Intercept:	9.6140E+01
R Square:	0.99973	Y-axis Intercept:	9.9862E-01

Low Concentration Diffusion Coefficient (cm2/sec):			4.8703E-10
Linear Range of Desorption, Relative Weight Fraction:			0.05 - 0.00
Slope:	-3.1536E-04	X-axis Intercept:	3.9231E+02
R Square:	0.97499	Y-axis Intercept:	1.2372E-01

Wt. @ Zero Time, mg K 143.60	Wt. @ Zero Time, % L 3.720	Adjustment to TGA Time, sec M 495	Hardness Shore Scale N D
TGA Dry Wt., mg 138.450	Equil. Wt. Of Desorb. Sample 138.41	Min. Wt. Used For FDC, mg. 138.410	Pre Exposure Hardness 72.6
High Conc. DC, cm2/sec 5.2834E-07	Low Conc. DC, cm2/sec 4.8703E-10	Total Liquid Sorbed, mg. 5.150	Post Desorption Hardness 73.4
R Square 0.99973	R Square 0.97499		Change in Hardness, % 1.1
X Intercept 96.14	X Intercept 392.3		Mean Thickness, cm. 0.1579
Y Intercept 0.99862	Y Intercept 0.12372		**abs0115d**
Y Intercept as Wt., mg. 143.402	X Intercept as Time, hrs. 42.8	X Intercept as Time, min. 256.5	X Intercept as Time, days 1.8
		Max. TGA Wt., (orig data file) 142.407	TGA Wt. At 20 min. Adjustment 141.729
		Sorption @ 7-12 min., mg 3.96	Sorption @ 20 min., mg 3.28
		Sorption @ 7-12 min., % 2.86	Sorption @ 20 min., % 2.37
		Rel. Error (%) of 7-12 min. Sorp. -23.2	Rel. Error (%) of 20 min. Sorp -36.3

TEMPERATURE STATISTICS

Column1	
Mean	30.00018454
Standard Error	0.000465527
Median	30
Mode	29.999
Standard Deviation	0.026895999
Sample Variance	0.000723395
Kurtosis	453.545885
Skewness	-12.8162299
Range	1.175
Minimum	29.141
Maximum	30.316
Sum	100140.616
Count	3338
Confidence Level(95.0%)	0.000912746

DIAMETER STATISTICS

	Column1	
	Mean	10.49
	Standard Error	0.06770032
	Median	10.495
	Mode	#N/A
	Standard Deviation	0.13540064
	Sample Variance	0.01833333
	Kurtosis	1.28419835
	Skewness	-0.2175362
	Range	0.33
	Minimum	10.32
	Maximum	10.65
ND/value	Sum	41.96
ND/value	Count	4
A/D	Confidence Level(95.0%)	0.21545284

THICKNESS STATISTICS

	Column1	
	Mean	62.175
	Standard Error	1.24121916
	Median	61.7
	Mode	#N/A
	Standard Deviation	2.48243832
	Sample Variance	6.1625
	Kurtosis	1.90364577
Unknown	Skewness	1.06966414
abs0115d	Range	5.9
	Minimum	59.7
	Maximum	65.6
	Sum	248.7
	Count	4
	Confidence Level(95.0%)	3.95011703

HIGH CONCENTRATION DIFFUSION COEFFICIENT

abs0115d

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999866631
R Square	0.999733281
Adjusted R Square	0.999723022
Standard Error	0.001187972
Observations	28

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.137535524	0.137535524	97454.6928	5.35851E-48
Residual	26	3.66932E-05	1.41128E-06		
Total	27	0.137572217			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.998619841	0.000977457	1021.651133	2.2026E-61	0.996610648	1.000629033
X Variable 1	-0.010387099	3.32731E-05	-312.1773418	5.3585E-48	-0.010455493	-0.010318705

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.987415446
R Square	0.974989262
Adjusted R Square	0.974970315
Standard Error	0.002339443
Observations	1322

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.281625661	0.281625661	51457.3321	0
Residual	1320	0.007224352	5.47299E-06		
Total	1321	0.288850013			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.123720738	0.000423464	292.1633424	0	0.122890002	0.124551474
X Variable 1	-0.000315365	1.39024E-06	-226.8420863	0	-0.000318092	-0.000312638

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: ABS (0115d)

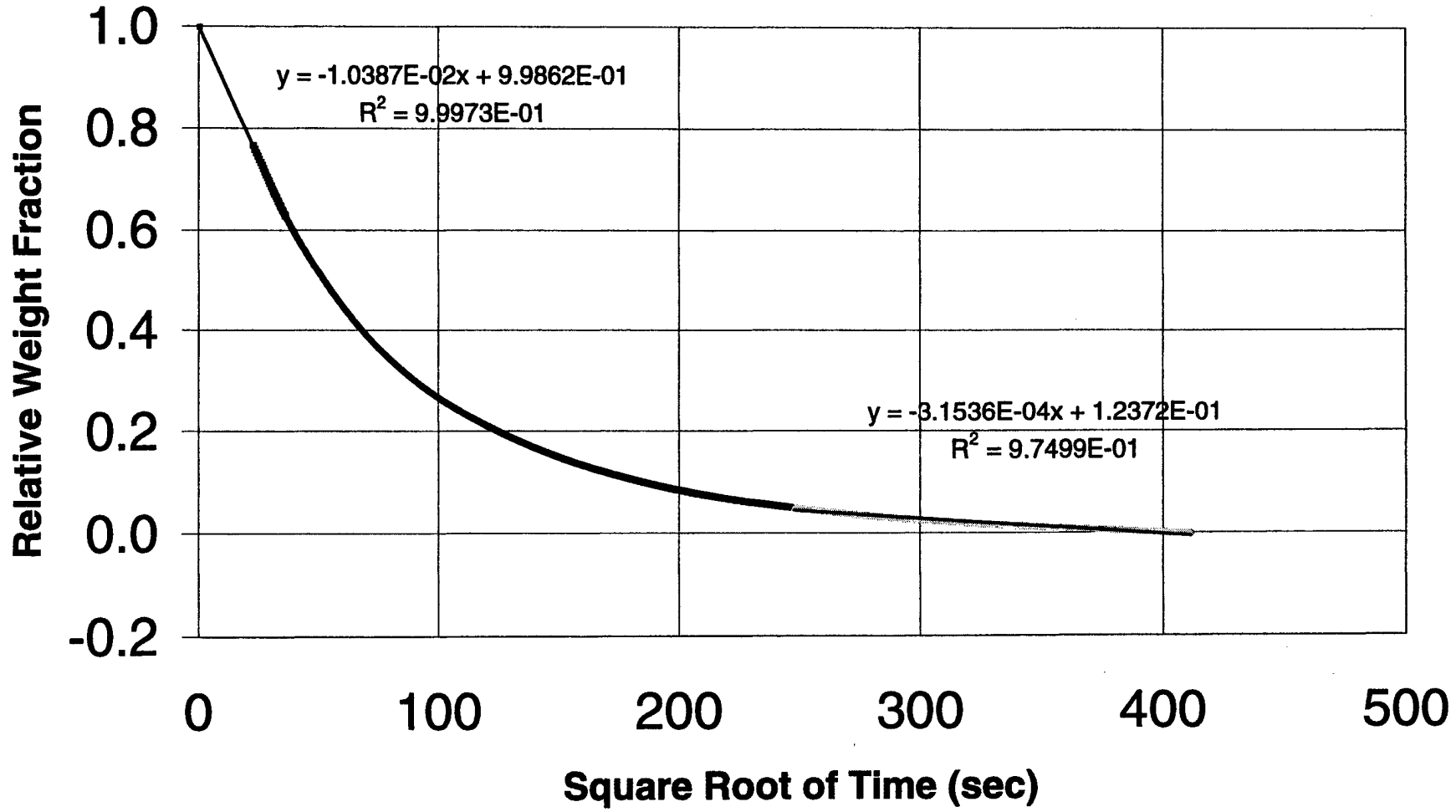


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: ABS (0115d)

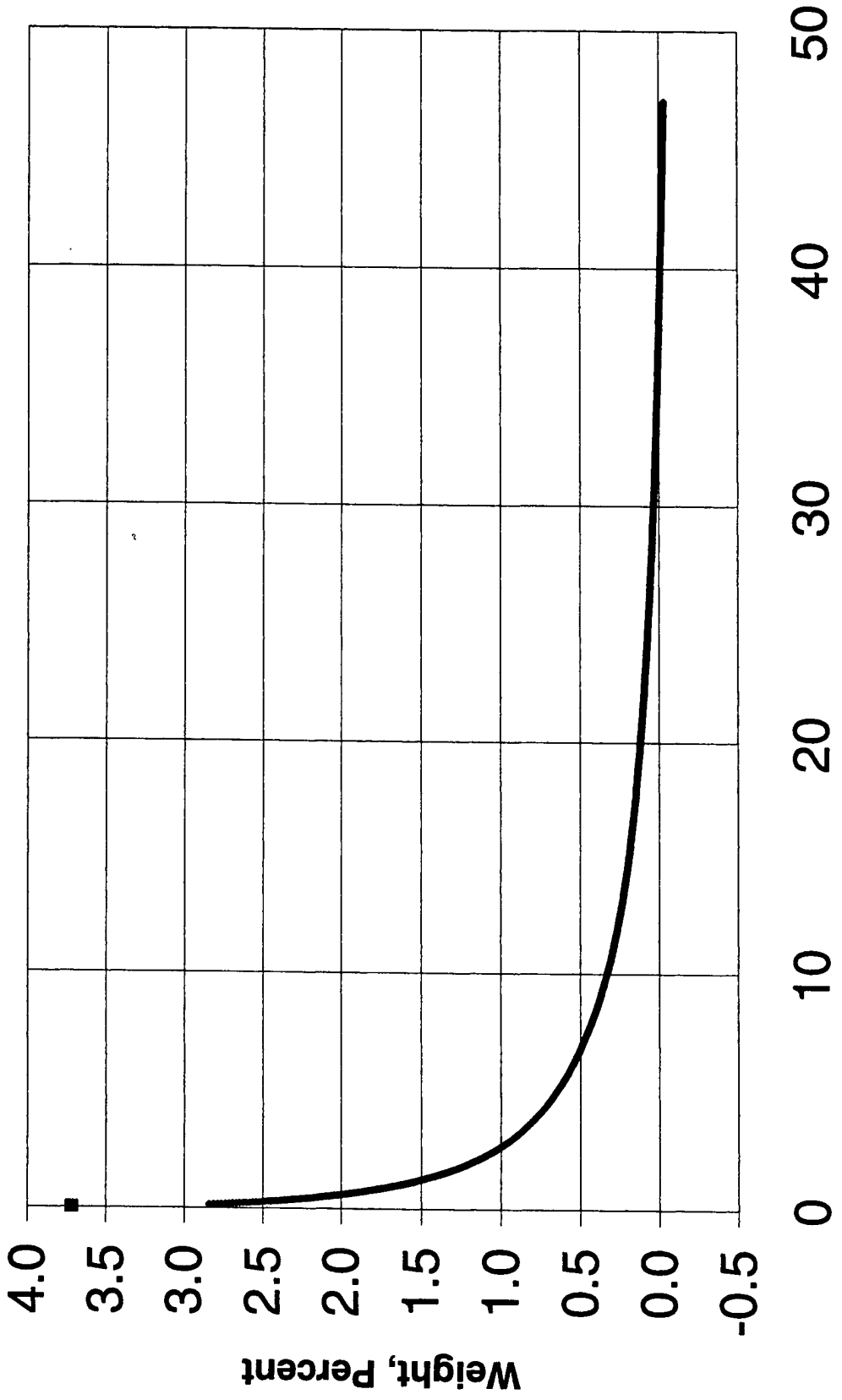


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: ABS (0115d)

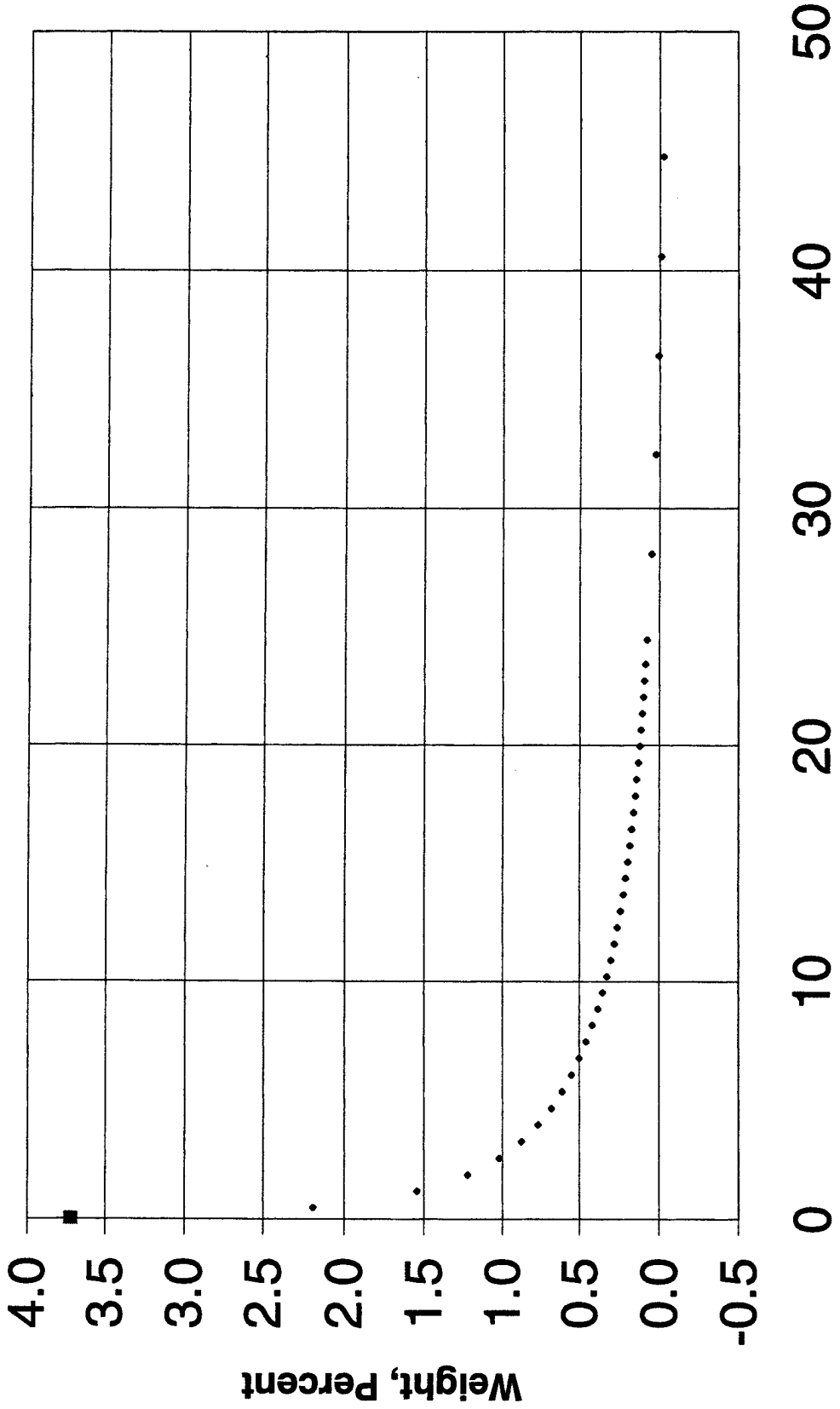
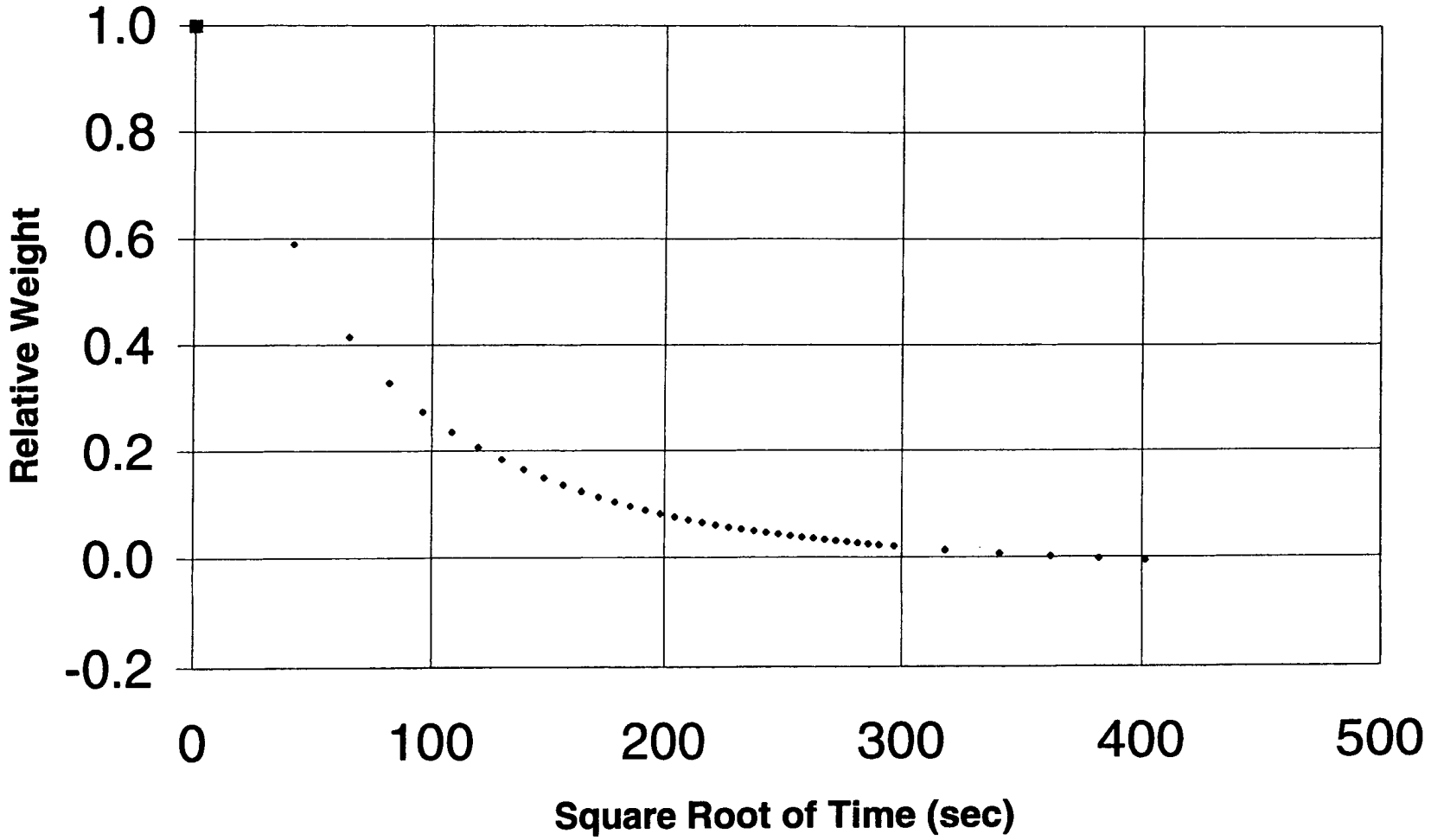


Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: ABS (0115d)



TGA Time, min	Temp., deg C	TGA Wt., mg	TGA Time, sec	Adjusted Time, sec	Adjusted Time, hr	SQRT Adj. Time, sec	Wt. Loss, %	Fractional Wt. Loss	Wt. @ Zero Time, mg	Wt. @ Zero Time, %	TGA Dry Wt., mg	Adjustment to TGA Time, sec	Hardness Scale
A	B	C	D	E	F	G	H	I	J	K	L	M	N
20.750	30.001	141.484	1245.000	1740.000	0.483	41.71	2.194	0.589	143.60	3.722	138.447	495	Shore D
62.426	30.001	140.584	3745.560	4240.560	1.178	65.12	1.544	0.415					
104.127	30.000	140.141	6247.620	6742.620	1.873	82.11	1.224	0.329					Pre Exposure
145.815	30.001	139.861	8748.900	9243.900	2.568	96.15	1.021	0.274	Formulae Used for Analysis of Data				Hardness
187.520	30.000	139.662	11251.200	11746.200	3.263	108.38	0.878	0.236	Uppercase letters refer to columns				72.6
229.212	30.000	139.512	13752.720	14247.720	3.958	119.36	0.769	0.207	Lowercase n refers to row, beginning with n=4				
270.917	30.000	139.392	16255.020	16750.020	4.653	129.42	0.683	0.183	----------				Post Desorption
312.612	30.000	139.294	18756.720	19251.720	5.348	138.75	0.612	0.164	Dn = (An * 60)				Hardness
354.315	30.000	139.212	21258.900	21753.900	6.043	147.49	0.553	0.148	En = (Dn + M4)				73.4
396.074	30.000	139.141	23764.440	24259.440	6.739	155.75	0.501	0.135	Fn = (En / 3600)				
437.818	30.000	139.080	26269.080	26764.080	7.434	163.60	0.457	0.123	Gn = SQRT (En)				Change in
479.576	30.000	139.025	28774.560	29269.560	8.130	171.08	0.417	0.112	Hn = (((Cn - L4) / L4) * 100)				Hardness, %
521.268	30.000	138.978	31276.080	31771.080	8.825	178.24	0.384	0.103	In = ((Cn - L4) / (J4 - L4))				1.10
562.958	30.000	138.936	33777.480	34272.480	9.520	185.13	0.353	0.095	K4 = (((J4 - L4) / L4) * 100)				
604.640	30.000	138.898	36278.400	36773.400	10.215	191.76	0.326	0.088	N16 = (((N12 – N8) /N8) * 100)				
646.338	30.000	138.864	38780.280	39275.280	10.910	198.18	0.301	0.081					
688.037	30.000	138.834	41282.220	41777.220	11.605	204.39	0.280	0.075					
729.746	30.000	138.806	43784.760	44279.760	12.300	210.43	0.259	0.070	Source binary TA data file : abs0115d.01				
771.465	30.000	138.781	46287.900	46782.900	12.995	216.29	0.241	0.065	14 lines in the parameter block				
813.211	30.000	138.758	48792.660	49287.660	13.691	222.01	0.225	0.060	3 channels of data				
854.883	30.000	138.737	51292.980	51787.980	14.386	227.57	0.209	0.056	----------				
896.590	30.000	138.718	53795.400	54290.400	15.081	233.00	0.196	0.053	Run 32				
938.299	30.000	138.701	56297.940	56792.940	15.776	238.31	0.183	0.049	Module TGA Aluminum Pans				
980.034	30.000	138.684	58802.040	59297.040	16.471	243.51	0.171	0.046	Sample ABS SCCO2 0115D				
1021.738	30.000	138.668	61304.280	61799.280	17.166	248.59	0.160	0.043	Size 142.407 mg				
1063.459	30.001	138.653	63807.540	64302.540	17.862	253.58	0.149	0.040	Method DESORPTION-Isothermal				
1105.162	30.000	138.641	66309.720	66804.720	18.557	258.47	0.140	0.038	Operator BSI				
1146.880	30.000	138.628	68812.800	69307.800	19.252	263.26	0.131	0.035	Comment Disk: .4x0.06in., HP@1400x50, Dry: TG-138.447 M-138.58 ET: 8:15				
1188.571	30.000	138.615	71314.260	71809.260	19.947	267.97	0.121	0.033	Nsig 3				
1230.279	30.000	138.604	73816.740	74311.740	20.642	272.60	0.113	0.030	Sig1 Time (min)				
1272.036	30.000	138.594	76322.160	76817.160	21.338	277.16	0.106	0.029	Sig2 Temperature (øC)				
1313.766	30.000	138.584	78825.960	79320.960	22.034	281.64	0.099	0.027	Sig3 Weight (mg)				
1355.487	30.000	138.574	81329.220	81824.220	22.729	286.05	0.092	0.025	Kcell 1.0000				
1397.192	30.000	138.565	83831.520	84326.520	23.424	290.39	0.085	0.023	Date 24-Apr-00				
1459.073	30.000	138.553	87544.380	88039.380	24.455	296.71	0.077	0.021	Time 15:21				
1676.427	30.000	138.515	100585.620	101080.620	28.078	317.93	0.049	0.013					
1926.431	30.000	138.482	115585.860	116080.860	32.245	340.71	0.025	0.007					
2176.436	30.000	138.456	130586.160	131081.160	36.411	362.05	0.007	0.002					
2426.437	30.000	138.434	145586.220	146081.220	40.578	382.21	-0.009	-0.003					
2676.438	30.000	138.415	160586.280	161081.280	44.745	401.35	-0.023	-0.006					

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FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Polyurethane PU

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	06-1-1	TGA Filename:	pu0124d
Property Test Specification:	ASTM D471/D543		
Material Name:	Polyurethane	Material Code:	PU
Material Supplier:	Unknown	Material Class:	U
Monomer Source:	Unknown	Base Polymer (Lot. No.):	Unknown
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	1

Pre-Exposure Data

Measured Diameter (mm):	9.82	9.68	9.84	9.63	
Mean Diameter:	9.750		95% Confidence Level (CL):		0.165
Measured Thickness (mils):	42.20	42.10	42.00	42.10	
Mean Thickness:	42.100		95% Confidence Level (CL):		0.130
Initial Sample Weight (mg):	132.580				
Initial Durometer Hardness:	96.9	Scale: SHORE		A	

Sample Exposure Data

Exposure Date:	05/03/00	Time:	10:26:00
Removal Date:	05/03/00	Time:	10:41:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	141.60
Weight Gain (mg):	9.02	Percent Weight Gain:	6.80
Final Durometer Hardness After Desorption:	97.0	Percent Hardness Change:	0.1

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.000	95% CL:	0.0009
Time Lapse Between Sample Exposure and Sample Desorption (sec):			555
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			132.210
Sample Extracted (mg):	0.37	Solubility Corrected for Extractables (mg):	9.39
Sample Extracted (%):	0.28	Solubility Corrected for Extractables (%):	7.08

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm2/sec):			2.5629E-07
Range Including 0,1 Intercept, Relative Weight Fraction:			1.00 - 0.62
Linear Range of Desorption, Relative Weight Fraction:			0.75 - 0.62
Slope:	-1.0684E-02	X-axis Intercept:	9.3874E+01
R Square:	0.99971	Y-axis Intercept:	1.0030E+00

Low Concentration Diffusion Coefficient (cm2/sec):			7.5549E-11
Linear Range of Desorption, Relative Weight Fraction:			0.03 - 0.00
Slope:	-1.8344E-04	X-axis Intercept:	2.7272E+02
R Square:	0.80890	Y-axis Intercept:	5.0026E-02

Wt. @ Zero Time, mg K 141.60	Wt. @ Zero Time, % L 6.803	Adjustment to TGA Time, sec M 555	Hardness Shore Scale N A
TGA Dry Wt., mg 132.580	Equil. Wt. Of Desorb. Sample 132.21	Min. Wt. Used For FDC, mg. 132.210	Pre Exposure Hardness 96.9
High Conc. DC, cm2/sec 2.5629E-07	Low Conc. DC, cm2/sec 7.5549E-11	Total Liquid Sorbed, mg. 9.020	Post Desorption Hardness 97.0
R Square 0.99971	R Square 0.80890		Change in Hardness, % 0.1
X Intercept 93.87	X Intercept 272.7		Mean Thickness, cm. 0.1069
Y Intercept 1.00296	Y Intercept 0.05003		**pu0124d**
Y Intercept as Wt., mg. 142.019	X Intercept as Time, hrs. 20.7	X Intercept as Time, min. 124.0	X Intercept as Time, days 0.9
		Max. TGA Wt., (orig data file) 139.304	TGA Wt. At 20 min. Adjustment 138.139
		Sorption @ 7-12 min., mg 6.72	Sorption @ 20 min., mg 5.56
		Sorption @ 7-12 min., % 5.07	Sorption @ 20 min., % 4.19
		Rel. Error (%) of 7-12 min. Sorp. -25.5	Rel. Error (%) of 20 min. Sorp -38.4

TEMPERATURE STATISTICS

Column1	
Mean	30.00004864
Standard Error	0.000470253
Median	30
Mode	30.002
Standard Deviation	0.025319519
Sample Variance	0.000641078
Kurtosis	483.2349079
Skewness	-15.26590206
Range	1.06
Minimum	29.197
Maximum	30.257
Sum	86970.141
Count	2899
Confidence Level(95.0%)	0.000922064

HIGH CONCENTRATION DIFFUSION COEFFICIENT

pu0124d

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999852658
R Square	0.999705338
Adjusted R Square	0.99969306
Standard Error	0.001298315
Observations	26

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.137252202	0.137252202	81425.24	6.90655E-44
Residual	24	4.04549E-05	1.68562E-06		
Total	25	0.137292657			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	1.002957462	0.001116626	898.2035895	7.7393E-56	1.00065286	1.005262064
X Variable 1	-0.010684114	3.7442E-05	-285.3510819	6.9066E-44	-0.01076139	-0.010606837

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.8993903
R Square	0.808902912
Adjusted R Square	0.808806203
Standard Error	0.003258879
Observations	1978

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.088831255	0.088831255	8364.29361	0
Residual	1976	0.0209857	1.06203E-05		
Total	1977	0.109816955			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.050025635	0.000482698	103.637583	0	0.049078985	0.050972286
X Variable 1	-0.000183435	2.00571E-06	-91.4565121	0	-0.000187369	-0.000179502

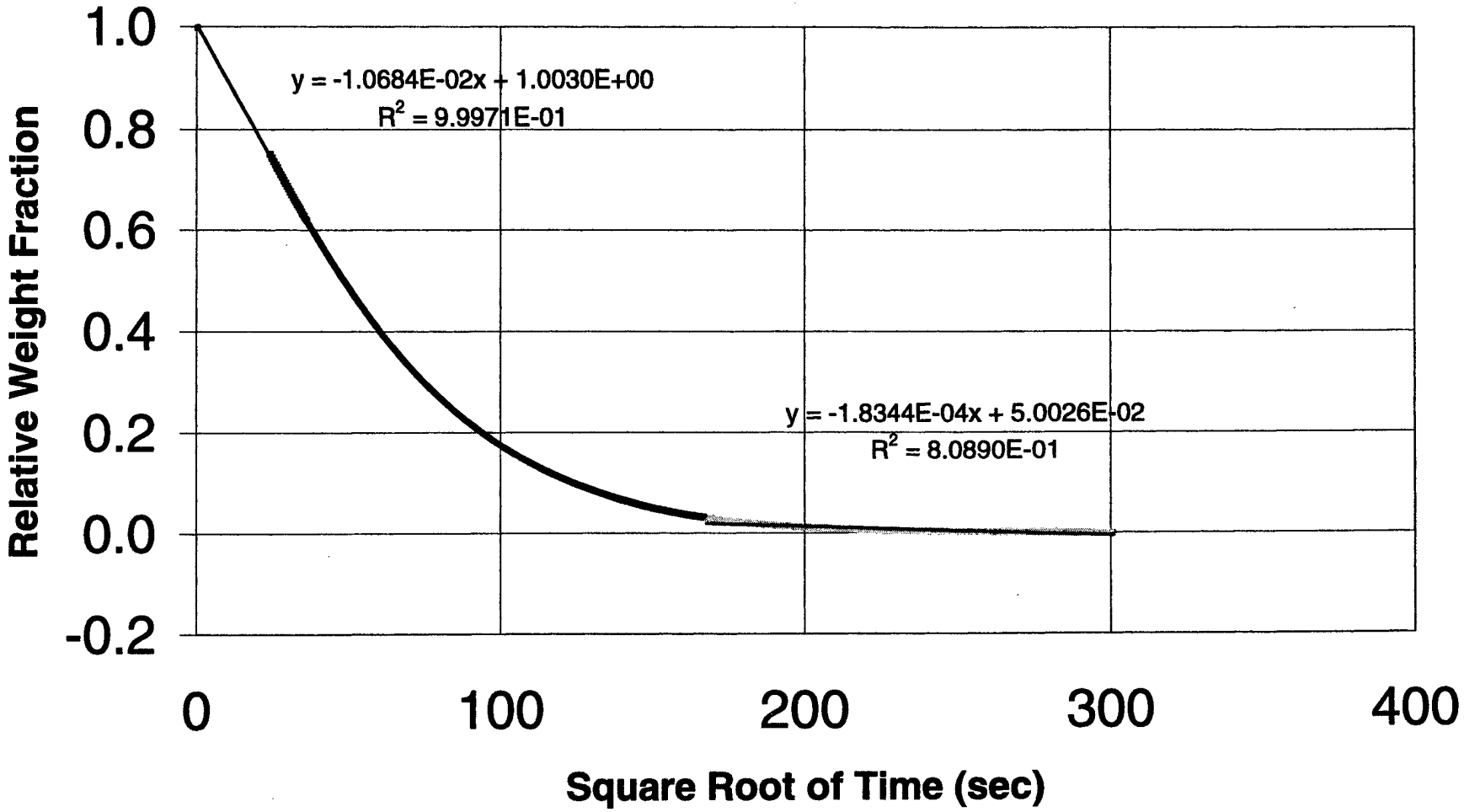
DIAMETER STATISTICS

	Column1	
	Mean	9.7425
	Standard Error	0.05170026
	Median	9.75
	Mode	#N/A
	Standard Deviation	0.10340052
	Sample Variance	0.01069167
	Kurtosis	-4.6970753
	Skewness	-0.1662108
	Range	0.21
	Minimum	9.63
	Maximum	9.84
ND/value	Sum	38.97
ND/value	Count	4
A/D	Confidence Level(95.0%)	0.16453345

THICKNESS STATISTICS

	Column1	
	Mean	42.1
	Standard Error	0.04082483
	Median	42.1
	Mode	42.1
	Standard Deviation	0.08164966
	Sample Variance	0.00666667
	Kurtosis	1.5
Unknown	Skewness	0
pu0124d	Range	0.2
	Minimum	42
	Maximum	42.2
	Sum	168.4
	Count	4
	Confidence Level(95.0%)	0.12992295

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PU (0124d)



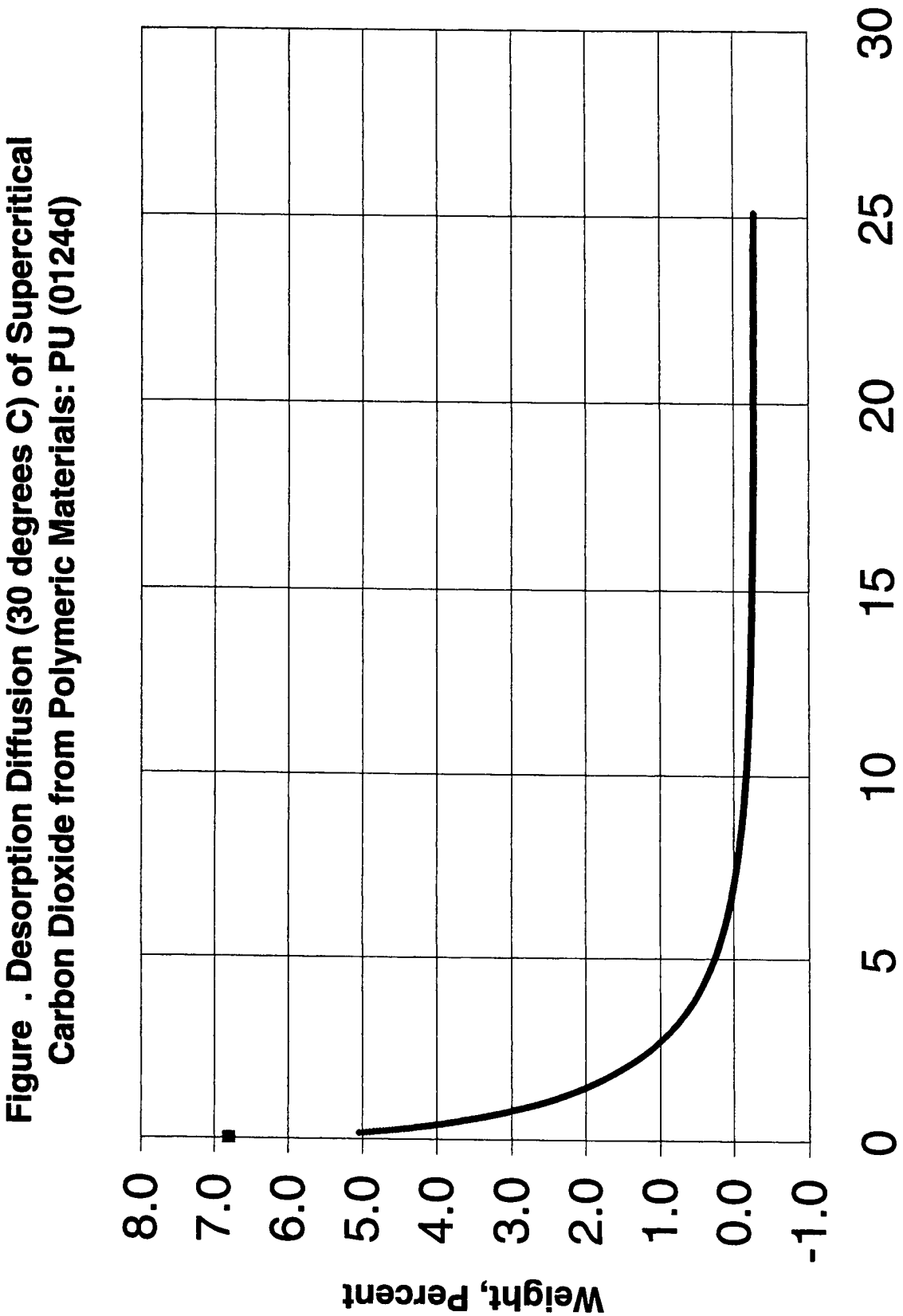
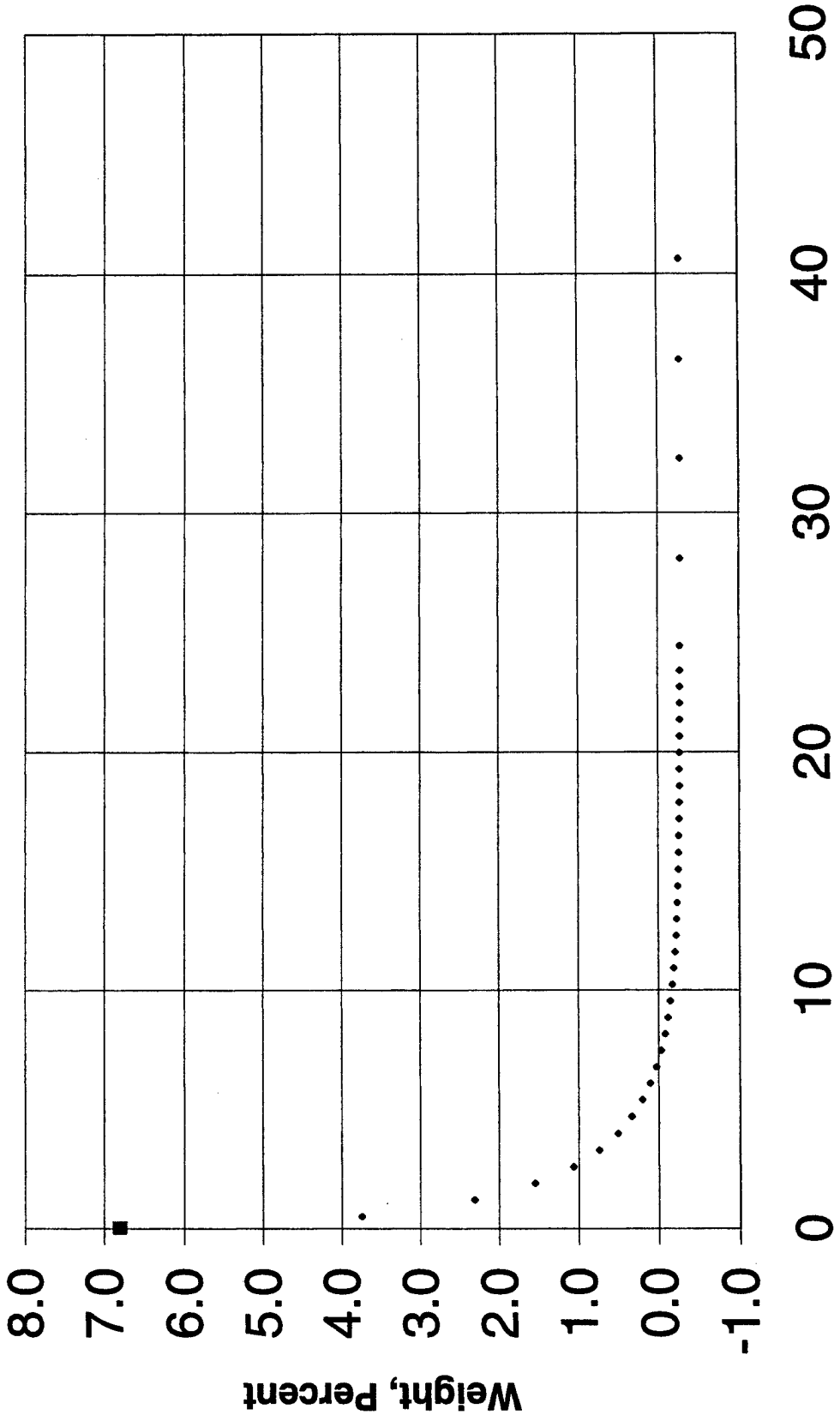


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PU (0124d)
Weight, Percent
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
0
5
10
15
20
25
30
Time, Hours

Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PU (0124d)



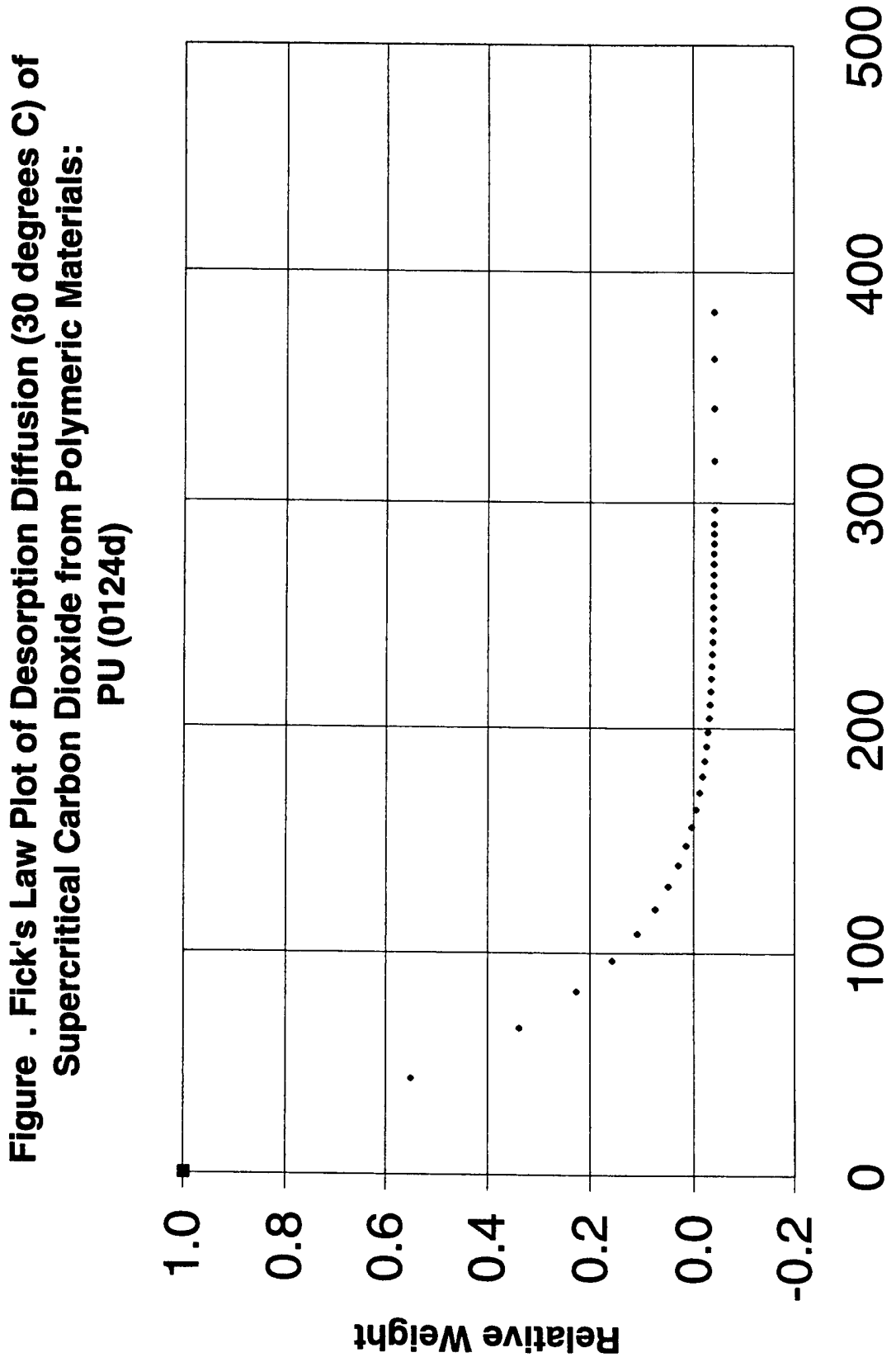


Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PU (0124d)
Relative Weight
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
0
100
200
300
400
500
Square Root of Time (sec)

TGA Time, min A	Temp., deg C B	TGA Wt., mg C	TGA Time, sec D	Adjusted Time, sec E	Adjusted Time, hr F	SQRT Adj. Time, sec G	Wt. Loss, % H	Fractional Wt. Loss I	Wt. @ Zero Time, mg J	Wt. @ Zero Time, % K	TGA Dry Wt., mg L	Adjustment to TGA Time, sec M	Hardness Scale N
20.767	29.997	137.544	1246.020	1801.020	0.500	42.44	3.748	0.551	141.60	6.807	132.575	555	Shore A
62.462	30.000	135.639	3747.720	4302.720	1.195	65.60	2.311	0.340					
104.169	30.000	134.631	6250.140	6805.140	1.890	82.49	1.551	0.228					Pre Exposure
145.852	30.000	133.993	8751.120	9306.120	2.585	96.47	1.070	0.157	Formulae Used for Analysis of Data				Hardness
187.552	30.000	133.558	11253.120	11808.120	3.280	108.67	0.741	0.109	Uppercase letters refer to columns				96.9
229.244	30.000	133.248	13754.640	14309.640	3.975	119.62	0.508	0.075	Lowercase n refers to row, beginning with n=4				
270.933	30.000	133.020	16255.980	16810.980	4.670	129.66	0.336	0.049	----------				Post Desorption
312.649	30.000	132.847	18758.940	19313.940	5.365	138.97	0.205	0.030	Dn = (An * 60)				Hardness
354.341	30.000	132.714	21260.460	21815.460	6.060	147.70	0.105	0.015	En = (Dn + M4)				97.0
396.060	30.000	132.612	23763.600	24318.600	6.755	155.94	0.028	0.004	Fn = (En / 3600)				
437.751	30.000	132.534	26265.060	26820.060	7.450	163.77	-0.031	-0.005	Gn = SQRT (En)				Change in
479.481	30.000	132.472	28768.860	29323.860	8.146	171.24	-0.078	-0.011	Hn = (((Cn - L4) / L4) * 100)				Hardness, %
521.185	30.000	132.423	31271.100	31826.100	8.841	178.40	-0.115	-0.017	In = ((Cn - L4) / (J4 - L4))				0.10
562.924	30.000	132.382	33775.440	34330.440	9.536	185.28	-0.146	-0.021	K4 = (((J4 - L4) / L4) * 100)				
604.616	30.001	132.351	36276.960	36831.960	10.231	191.92	-0.169	-0.025	N16 = (((N12 – N8) /N8) * 100)				
646.286	30.000	132.326	38777.160	39332.160	10.926	198.32	-0.188	-0.028					
687.966	30.000	132.305	41277.960	41832.960	11.620	204.53	-0.204	-0.030					
729.669	30.000	132.288	43780.140	44335.140	12.315	210.56	-0.216	-0.032	Source binary TA data file : pu0124d.01				
771.375	30.000	132.275	46282.500	46837.500	13.010	216.42	-0.226	-0.033	14 lines in the parameter block				
813.131	30.000	132.264	48787.860	49342.860	13.706	222.13	-0.235	-0.034	3 channels of data				
854.838	30.000	132.256	51290.280	51845.280	14.401	227.70	-0.241	-0.035	----------				
896.567	30.000	132.247	53794.020	54349.020	15.097	233.13	-0.247	-0.036	Run 34				
938.305	30.001	132.240	56298.300	56853.300	15.793	238.44	-0.253	-0.037	Module TGA Aluminum Pans				
980.016	30.000	132.235	58800.960	59355.960	16.488	243.63	-0.256	-0.038	Sample PU SCCO2 124D				
1021.711	30.000	132.230	61302.660	61857.660	17.183	248.71	-0.260	-0.038	Size 139.304 mg				
1063.432	30.000	132.227	63805.920	64360.920	17.878	253.69	-0.262	-0.039	Method DESORPTION-Isothermal				
1105.143	30.000	132.224	66308.580	66863.580	18.573	258.58	-0.265	-0.039	Operator WJS				
1146.859	30.000	132.222	68811.540	69366.540	19.268	263.38	-0.266	-0.039	Comment Disk: .382x.0668IN, HP@1400x50, Dry: TG-132.575 M-132.81 ET:9:15				
1188.582	30.000	132.221	71314.920	71869.920	19.964	268.09	-0.267	-0.039	Nsig 3				
1230.274	30.000	132.219	73816.440	74371.440	20.659	272.71	-0.269	-0.039	Sig1 Time (min)				
1272.005	30.000	132.217	76320.300	76875.300	21.354	277.26	-0.270	-0.040	Sig2 Temperature (øC)				
1313.726	30.000	132.216	78823.560	79378.560	22.050	281.74	-0.271	-0.040	Sig3 Weight (mg)				
1355.488	30.000	132.215	81329.280	81884.280	22.746	286.15	-0.272	-0.040	Kcell 1.0000				
1397.207	30.000	132.214	83832.420	84387.420	23.441	290.50	-0.272	-0.040	Date 3-May-00				
1459.451	30.000	132.212	87567.060	88122.060	24.478	296.85	-0.274	-0.040	Time 10:51				
1677.250	30.000	132.210	100635.000	101190.000	28.108	318.10	-0.275	-0.040					
1927.272	30.000	132.210	115636.320	116191.320	32.275	340.87	-0.275	-0.040					
2177.279	30.000	132.210	130636.740	131191.740	36.442	362.20	-0.275	-0.040					
2427.284	30.000	132.211	145637.040	146192.040	40.609	382.35	-0.275	-0.040					

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FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Silicone Modified Organic SMO

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	07-1-1	TGA Filename:	smo0129d
Property Test Specification:	ASTM D471/D543		
Material Name:	Silicone Modified Organic	Material Code:	SMO
Material Supplier:	Unknown	Material Class:	Q
Monomer Source:	Unknown	Base Polymer (Lot. No.):	Unknown
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	1

Pre-Exposure Data

Measured Diameter (mm):		9.83	9.91	9.90	9.80	
Mean Diameter:	9.865			95% Confidence Level (CL):		0.085
Measured Thickness (mils):		75.00	74.90	75.00	75.10	
Mean Thickness:	75.000			95% Confidence Level (CL):		0.130
Initial Sample Weight (mg):		148.460				
Initial Durometer Hardness:		58.6	Scale: SHORE		A	

Sample Exposure Data

Exposure Date:	05/08/00	Time:	14:25:00
Removal Date:	05/08/00	Time:	14:40:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	155.80
Weight Gain (mg):	7.34	Percent Weight Gain:	4.94
Final Durometer Hardness After Desorption:	58.9	Percent Hardness Change:	0.5

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.000	95% CL:	0.0013
Time Lapse Between Sample Exposure and Sample Desorption (sec):			615
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			148.750
Sample Extracted (mg):	-0.29	Solubility Corrected for Extractables (mg):	7.34
Sample Extracted (%):	-0.20	Solubility Corrected for Extractables (%):	4.94

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm2/sec):			5.1028E-07
Range Including 0,1 Intercept, Relative Weight Fraction:			1.00 - 0.66
Linear Range of Desorption, Relative Weight Fraction:			0.79 - 0.66
Slope:	-8.4624E-03	X-axis Intercept:	1.1827E+02
R Square:	0.99995	Y-axis Intercept:	1.0008E+00

Low Concentration Diffusion Coefficient (cm2/sec):			2.8522E-09
Linear Range of Desorption, Relative Weight Fraction:			0.07 - 0.04
Slope:	-6.3267E-04	X-axis Intercept:	3.3044E+02
R Square:	0.99463	Y-axis Intercept:	2.0906E-01

Wt. @ Zero Time, mg K 155.80	Wt. @ Zero Time, % L 4.944	Adjustment to TGA Time, sec M 615	Hardness Shore Scale N A
TGA Dry Wt., mg 148.460	Equil. Wt. Of Desorb. Sample 148.75	Min. Wt. Used For FDC, mg. 148.460	Pre Exposure Hardness 58.6
High Conc. DC, cm2/sec 5.1028E-07	Low Conc. DC, cm2/sec 2.8522E-09	Total Liquid Sorbed, mg. 7.340	Post Desorption Hardness 58.9
R Square 0.99995	R Square 0.99463		Change in Hardness, % 0.5
X Intercept 118.27	X Intercept 330.4		Mean Thickness, cm. 0.1905
Y Intercept 1.00083	Y Intercept 0.20906		**smo0129d**
Y Intercept as Wt., mg. 155.930	X Intercept as Time, hrs. 30.3	X Intercept as Time, min. 182.0	X Intercept as Time, days 1.3
		Max. TGA Wt., (orig data file) 154.274	TGA Wt. At 20 min. Adjustment 153.654
		Sorption @ 7-12 min., mg 5.81	Sorption @ 20 min., mg 5.19
		Sorption @ 7-12 min., % 3.92	Sorption @ 20 min., % 3.50
		Rel. Error (%) of 7-12 min. Sorp. -20.8	Rel. Error (%) of 20 min. Sorp -29.2

TEMPERATURE STATISTICS

Column1	
Mean	30.00005822
Standard Error	0.000677744
Median	30
Mode	30
Standard Deviation	0.033354348
Sample Variance	0.001112513
Kurtosis	358.3810313
Skewness	-12.57316686
Range	1.248
Minimum	29.076
Maximum	30.324
Sum	72660.141
Count	2422
Confidence Level(95.0%)	0.001329017

HIGH CONCENTRATION DIFFUSION COEFFICIENT

smo0129d

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999975055
R Square	0.99995011
Adjusted R Square	0.999948643
Standard Error	0.000437112
Observations	36

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.13020571	0.13020571	681465.356	9.98267E-75
Residual	34	6.49629E-06	1.91067E-07		
Total	35	0.130212206			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	1.00083354	0.000340523	2939.109506	1.7733E-93	1.000141515	1.001525565
X Variable 1	-0.008462427	1.02512E-05	-825.5091498	9.9827E-75	-0.00848326	-0.008441594

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.997312275
R Square	0.994631773
Adjusted R Square	0.994625129
Standard Error	0.000662618
Observations	810

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.06573076	0.06573076	149707.254	0
Residual	808	0.000354762	4.39062E-07		
Total	809	0.066085522			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.20905919	0.000404425	516.9300144	0	0.208265344	0.209853037
X Variable 1	-0.000632674	1.63515E-06	-386.9202161	0	-0.000635884	-0.000629464

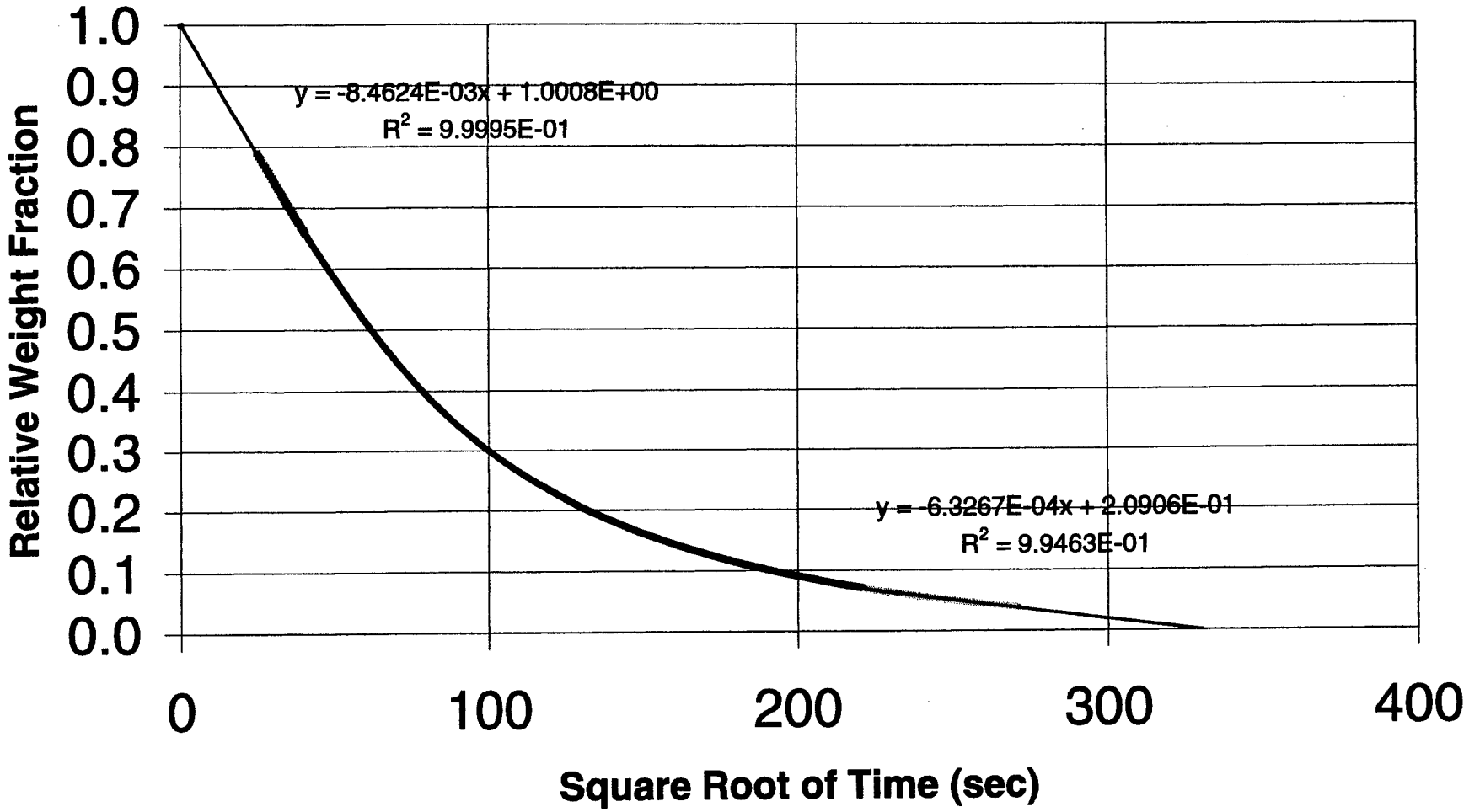
DIAMETER STATISTICS

	Column1	
	Mean	9.86
	Standard Error	0.02677063
	Median	9.865
	Mode	#N/A
	Standard Deviation	0.05354126
	Sample Variance	0.00286667
	Kurtosis	-4.3409951
	Skewness	-0.2345507
	Range	0.11
	Minimum	9.8
	Maximum	9.91
ND/value	Sum	39.44
ND/value	Count	4
A/D	Confidence Level(95.0%)	0.08519617

THICKNESS STATISTICS

	Column1	
	Mean	75
	Standard Error	0.04082483
	Median	75
	Mode	75
	Standard Deviation	0.08164966
	Sample Variance	0.00666667
	Kurtosis	1.5
Unknown	Skewness	0
smo0129d	Range	0.2
	Minimum	74.9
	Maximum	75.1
	Sum	300
	Count	4
	Confidence Level(95.0%)	0.12992295

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: SMO (0129d)



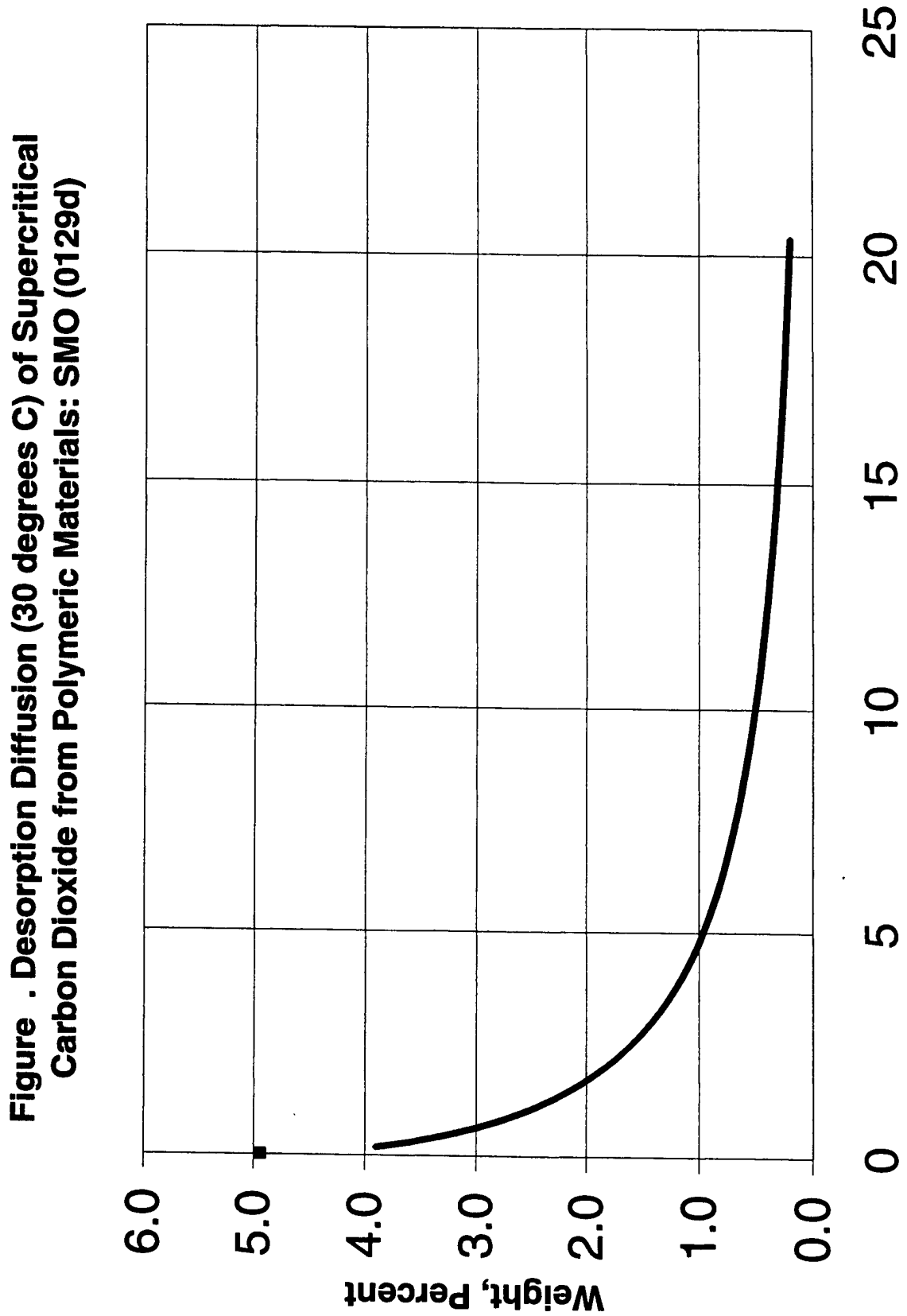
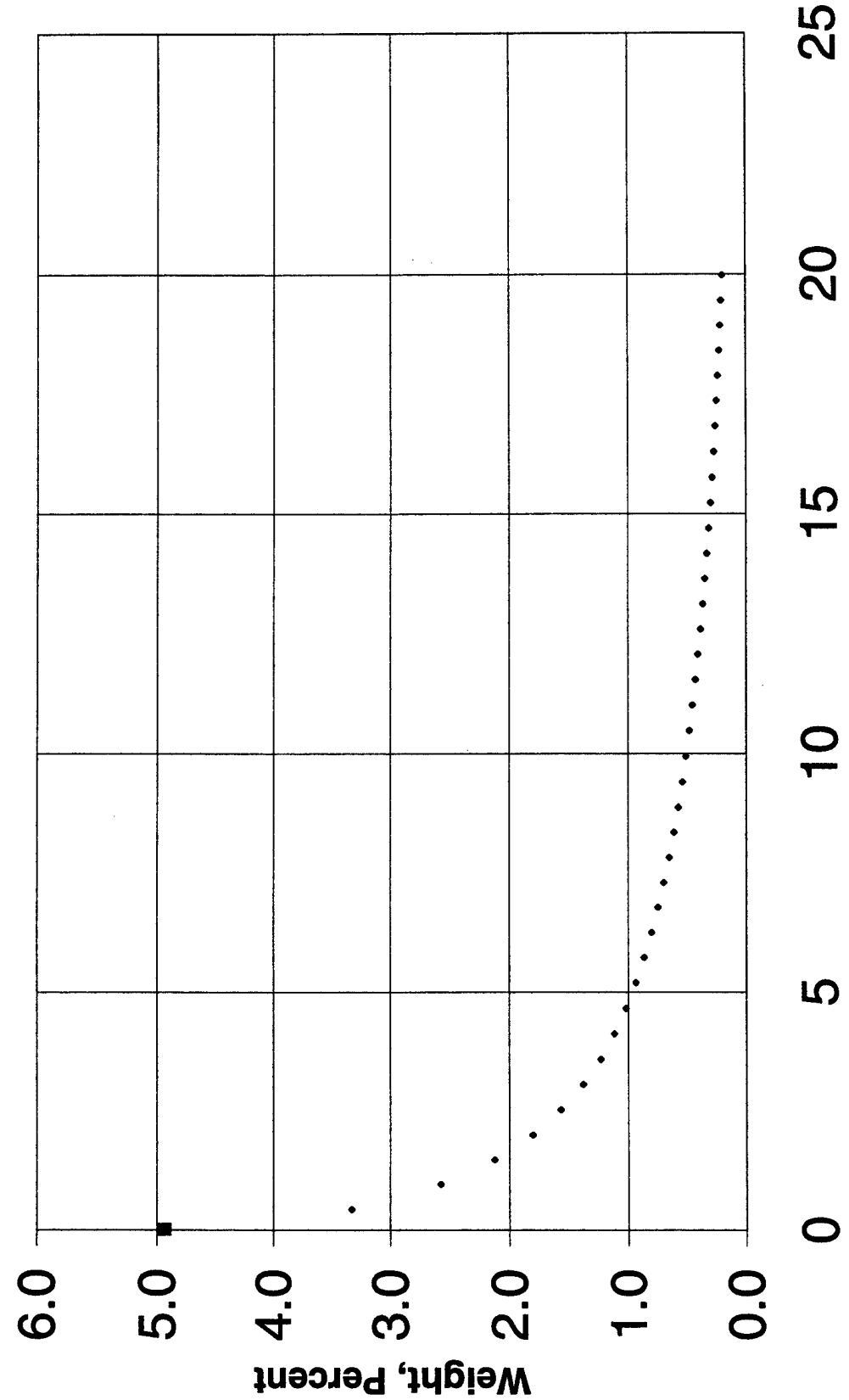


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: SMO (0129d)

Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: SMO (0129d)



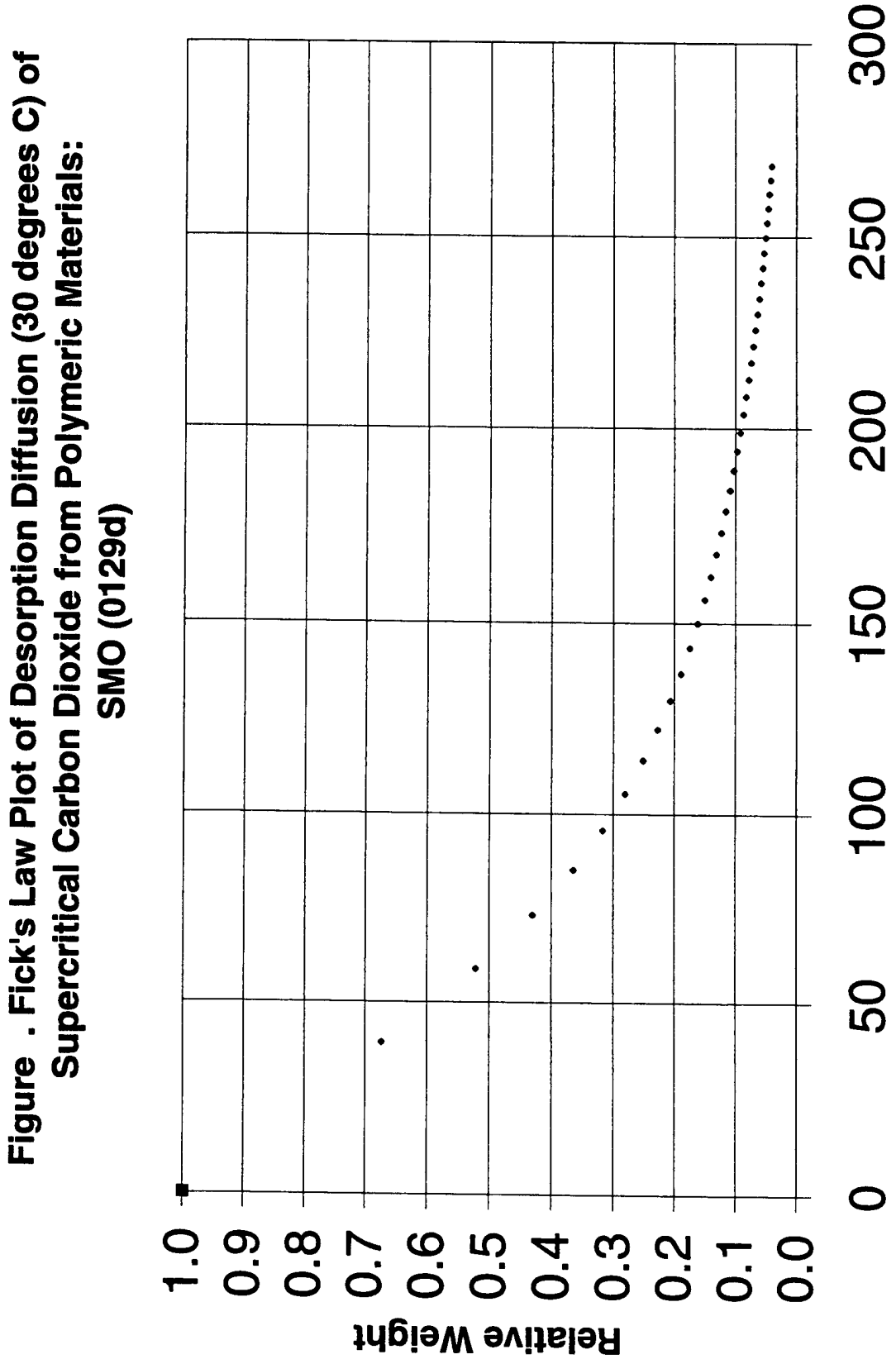


Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: SMO (0129d)
Relative Weight
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
50
100
150
200
250
300
Square Root of Time (sec)

TGA Time, min	Temp., deg C	TGA Wt., mg	TGA Time, sec	Adjusted Time, sec	Adjusted Time, hr	SQRT Adj. Time, sec	Wt. Loss, %	Fractional Wt. Loss	Wt. @ Zero Time, mg	Wt. @ Zero Time, %	TGA Dry Wt., mg	Adjustment to TGA Time, sec	Hardness Scale
A	B	C	D	E	F	G	H	I	J	K	L	M	N
15.749	29.995	153.404	944.940	1559.940	0.433	39.50	3.329	0.674	155.80	4.943	148.461	615	Shore A
47.420	30.000	152.291	2845.200	3460.200	0.961	58.82	2.580	0.522					
79.097	30.000	151.616	4745.820	5360.820	1.489	73.22	2.125	0.430					Pre Exposure
110.807	30.001	151.143	6648.420	7263.420	2.018	85.23	1.807	0.365	Formulae Used for Analysis of Data				Hardness
142.543	30.000	150.792	8552.580	9167.580	2.547	95.75	1.570	0.318	Uppercase letters refer to columns				58.6
174.253	30.000	150.519	10455.180	11070.180	3.075	105.21	1.386	0.280	Lowercase n refers to row, beginning with n=4				
206.012	30.001	150.301	12360.720	12975.720	3.604	113.91	1.239	0.251	----------				Post Desorption
237.705	30.000	150.125	14262.300	14877.300	4.133	121.97	1.121	0.227	Dn = (An * 60)				Hardness
269.414	30.000	149.977	16164.840	16779.840	4.661	129.54	1.021	0.207	En = (Dn + M4)				58.9
301.101	30.000	149.851	18066.060	18681.060	5.189	136.68	0.936	0.189	Fn = (En / 3600)				
332.793	30.000	149.743	19967.580	20582.580	5.717	143.47	0.864	0.175	Gn = SQRT (En)				Change in
364.478	30.001	149.648	21868.680	22483.680	6.245	149.95	0.800	0.162	Hn = (((Cn - L4) / L4) * 100)				Hardness, %
396.186	30.000	149.565	23771.160	24386.160	6.774	156.16	0.744	0.150	In = ((Cn - L4) / (J4 - L4))				0.51
427.866	30.000	149.492	25671.960	26286.960	7.302	162.13	0.694	0.140	K4 = (((J4 - L4) / L4) * 100)				
459.545	30.000	149.425	27572.700	28187.700	7.830	167.89	0.649	0.131	N16 = (((N12 – N8) /N8) * 100)				
491.228	30.001	149.366	29473.680	30088.680	8.358	173.46	0.610	0.123					
522.944	30.000	149.312	31376.640	31991.640	8.887	178.86	0.573	0.116					
554.627	30.000	149.261	33277.620	33892.620	9.415	184.10	0.539	0.109	Source binary TA data file : smo0129d.01				
586.301	30.000	149.216	35178.060	35793.060	9.943	189.19	0.509	0.103	14 lines in the parameter block				
618.012	30.000	149.173	37080.720	37695.720	10.471	194.15	0.480	0.097	3 channels of data				
649.699	30.000	149.135	38981.940	39596.940	10.999	198.99	0.454	0.092	----------				
681.383	30.000	149.098	40882.980	41497.980	11.527	203.71	0.429	0.087	Run 36				
713.057	30.000	149.065	42783.420	43398.420	12.055	208.32	0.407	0.082	Module TGA Aluminum Pans				
744.757	30.000	149.033	44685.420	45300.420	12.583	212.84	0.385	0.078	Sample SMO GPM SCCO2 0129D Disk				
776.478	30.000	149.004	46588.680	47203.680	13.112	217.26	0.366	0.074	Size 154.274 mg				
808.167	30.000	148.977	48490.020	49105.020	13.640	221.60	0.348	0.070	Method DESORPTION-Isothermal				
839.861	30.000	148.952	50391.660	51006.660	14.169	225.85	0.331	0.067	Operator BSI				
871.534	30.000	148.928	52292.040	52907.040	14.696	230.02	0.315	0.064	Comment .38"x.075",HP@1400x50,Dry:DS-148.3 M-148.54 TG-148.461 ET:10:15				
903.217	30.000	148.906	54193.020	54808.020	15.224	234.11	0.300	0.061	Nsig 3				
934.902	30.000	148.885	56094.120	56709.120	15.753	238.14	0.286	0.058	Sig1 Time (min)				
966.589	30.000	148.865	57995.340	58610.340	16.281	242.10	0.272	0.055	Sig2 Temperature (øC)				
998.272	30.000	148.847	59896.320	60511.320	16.809	245.99	0.260	0.053	Sig3 Weight (mg)				
1029.960	30.001	148.829	61797.600	62412.600	17.337	249.83	0.248	0.050	Kcell 1.0000				
1061.642	29.999	148.813	63698.520	64313.520	17.865	253.60	0.237	0.048	Date 8-May-00				
1093.338	30.001	148.797	65600.280	66215.280	18.393	257.32	0.226	0.046	Time 14:51				
1125.067	30.000	148.783	67504.020	68119.020	18.922	261.00	0.217	0.044					
1156.749	30.000	148.769	69404.940	70019.940	19.450	264.61	0.207	0.042					
1188.439	30.000	148.756	71306.340	71921.340	19.978	268.18	0.199	0.040					

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FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Polyethylene-propylene PEP

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	08-1-1	TGA Filename:	pep0130d
Property Test Specification:	ASTM D471/D543		
Material Name:	Polyethylene-propylene	Material Code:	PEP
Material Supplier:	Smithers Scientific	Material Class:	EPM
Monomer Source:	Dupont	Base Polymer (Lot. No.):	Nordel 2744
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	1

Pre-Exposure Data

Measured Diameter (mm):	9.82	9.87	9.81	9.87		
Mean Diameter:	9.845		95% Confidence Level (CL):			0.051
Measured Thickness (mils):	48.40	48.50	49.20	48.60		
Mean Thickness:	48.675		95% Confidence Level (CL):			0.572
Initial Sample Weight (mg):	114.050					
Initial Durometer Hardness:	93.6	Scale: SHORE		A		

Sample Exposure Data

Exposure Date:	05/09/00	Time:	11:21:00
Removal Date:	05/09/00	Time:	11:36:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	117.60
Weight Gain (mg):	3.55	Percent Weight Gain:	3.11
Final Durometer Hardness After Desorption:	93.9	Percent Hardness Change:	0.3

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.000	95% CL:	0.0015
Time Lapse Between Sample Exposure and Sample Desorption (sec):			635
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			113.930
Sample Extracted (mg):	0.12	Solubility Corrected for Extractables (mg):	3.67
Sample Extracted (%):	0.11	Solubility Corrected for Extractables (%):	3.22

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm2/sec):			1.1302E-06
Range Including 0,1 Intercept, Relative Weight Fraction:			1.00 - 0.30
Linear Range of Desorption, Relative Weight Fraction:			0.50 - 0.30
Slope:	-1.9405E-02	X-axis Intercept:	5.1234E+01
R Square:	0.99918	Y-axis Intercept:	9.9420E-01

Low Concentration Diffusion Coefficient (cm2/sec):			5.7250E-11
Linear Range of Desorption, Relative Weight Fraction:			0.03 - 0.00
Slope:	-1.3811E-04	X-axis Intercept:	2.7238E+02
R Square:	0.96751	Y-axis Intercept:	3.7619E-02

Wt. @ Zero Time, mg K 117.60	Wt. @ Zero Time, % L 3.113	Adjustment to TGA Time, sec M 635	Hardness Shore Scale N A
TGA Dry Wt., mg 114.050	Equil. Wt. Of Desorb. Sample 113.93	Min. Wt. Used For FDC, mg. 113.930	Pre Exposure Hardness 93.6
High Conc. DC, cm2/sec 1.1302E-06	Low Conc. DC, cm2/sec 5.7250E-11	Total Liquid Sorbed, mg. 3.550	Post Desorption Hardness 93.9
R Square 0.99918	R Square 0.96751		Change in Hardness, % 0.3
X Intercept 51.23	X Intercept 272.4		Mean Thickness, cm. 0.1236
Y Intercept 0.99420	Y Intercept 0.03762		**pep0130d**
Y Intercept as Wt., mg. 116.918	X Intercept as Time, hrs. 20.6	X Intercept as Time, min. 123.7	X Intercept as Time, days 0.9
		Max. TGA Wt., (orig data file) 115.799	TGA Wt. At 20 min. Adjustment 115.116
		Sorption @ 7-12 min., mg 1.75	Sorption @ 20 min., mg 1.07
		Sorption @ 7-12 min., % 1.53	Sorption @ 20 min., % 0.93
		Rel. Error (%) of 7-12 min. Sorp. -50.7	Rel. Error (%) of 20 min. Sorp -70.0

TEMPERATURE STATISTICS

Column1	
Mean	30.00029496
Standard Error	0.000777476
Median	30
Mode	30
Standard Deviation	0.040540732
Sample Variance	0.001643551
Kurtosis	367.9197048
Skewness	-11.59879076
Range	1.577
Minimum	28.823
Maximum	30.4
Sum	81570.802
Count	2719
Confidence Level(95.0%)	0.001524505

DIAMETER STATISTICS

	Column1	
	Mean	9.8425
	Standard Error	0.01600781
	Median	9.845
	Mode	9.87
	Standard Deviation	0.03201562
	Sample Variance	0.001025
	Kurtosis	-5.518144
	Skewness	-0.0838006
	Range	0.06
	Minimum	9.81
	Maximum	9.87
ND/value	Sum	39.37
ND/value	Count	4
A/D	Confidence Level(95.0%)	0.05094405

THICKNESS STATISTICS

	Column1	
	Mean	48.675
	Standard Error	0.17969882
	Median	48.55
	Mode	#N/A
	Standard Deviation	0.35939764
	Sample Variance	0.12916667
	Kurtosis	3.01436004
Nordel 2744	Skewness	1.6963868
pep0130d	Range	0.8
	Minimum	48.4
	Maximum	49.2
	Sum	194.7
	Count	4
	Confidence Level(95.0%)	0.57188239

HIGH CONCENTRATION DIFFUSION COEFFICIENT

pep0130d

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999591299
R Square	0.999182765
Adjusted R Square	0.999147233
Standard Error	0.004020398
Observations	25

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.4545315	0.4545315	28120.6817	5.11105E-37
Residual	23	0.000371763	1.61636E-05		
Total	24	0.454903263			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.994201567	0.003567351	278.694592	4.3336E-42	0.986821948	1.001581186
X Variable 1	-0.019405033	0.000115718	-167.692223	5.111E-37	-0.019644414	-0.019165652

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

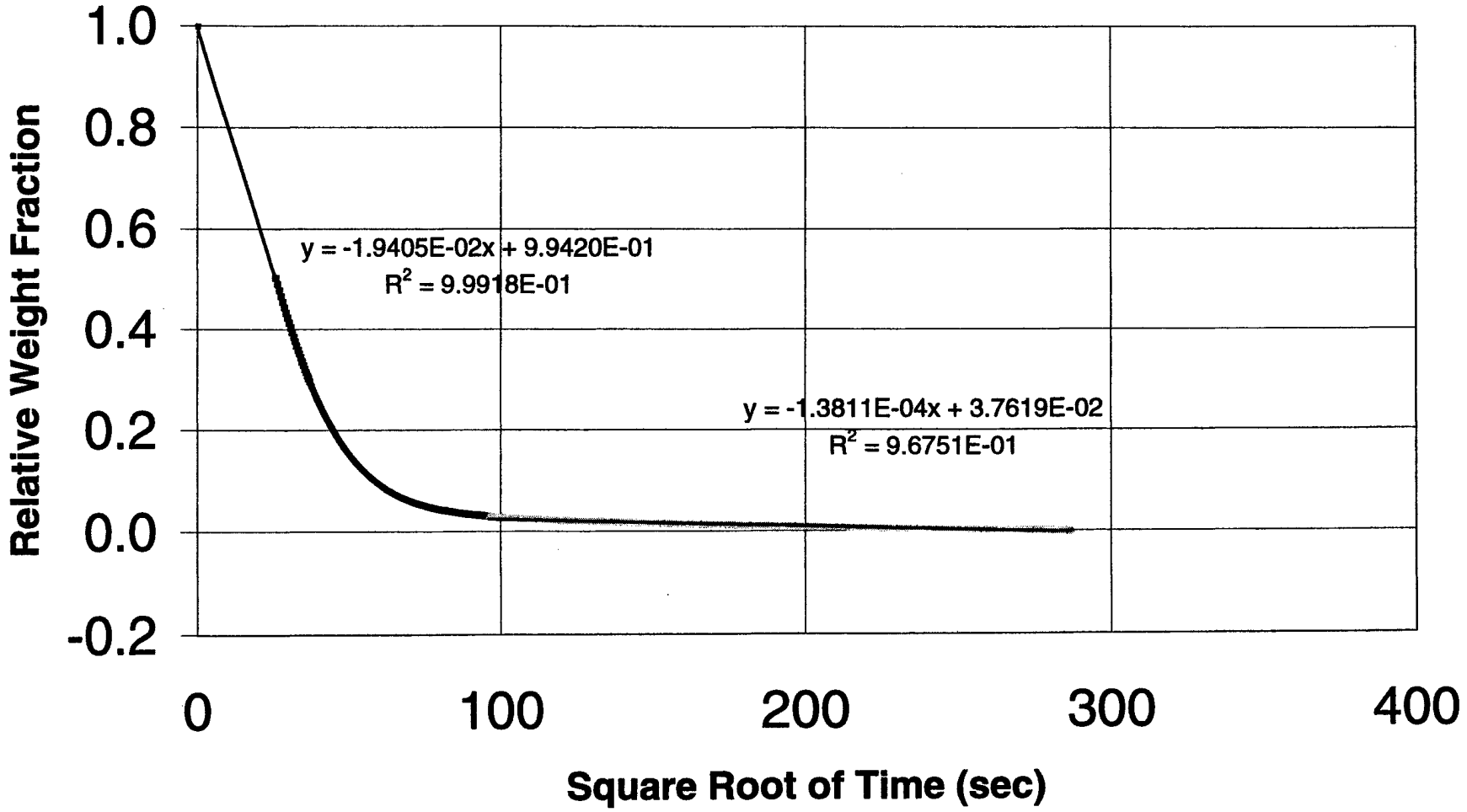
Regression Statistics	
Multiple R	0.983619271
R Square	0.96750687
Adjusted R Square	0.967493509
Standard Error	0.001336773
Observations	2434

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.129402078	0.129402078	72414.5898	0
Residual	2432	0.00434589	1.78696E-06		
Total	2433	0.133747969			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.03761904	0.000109758	342.7448567	0	0.037403811	0.037834269
X Variable 1	-0.000138113	5.1324E-07	-269.0995908	0	-0.000139119	-0.000137106

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PEP (0130d)



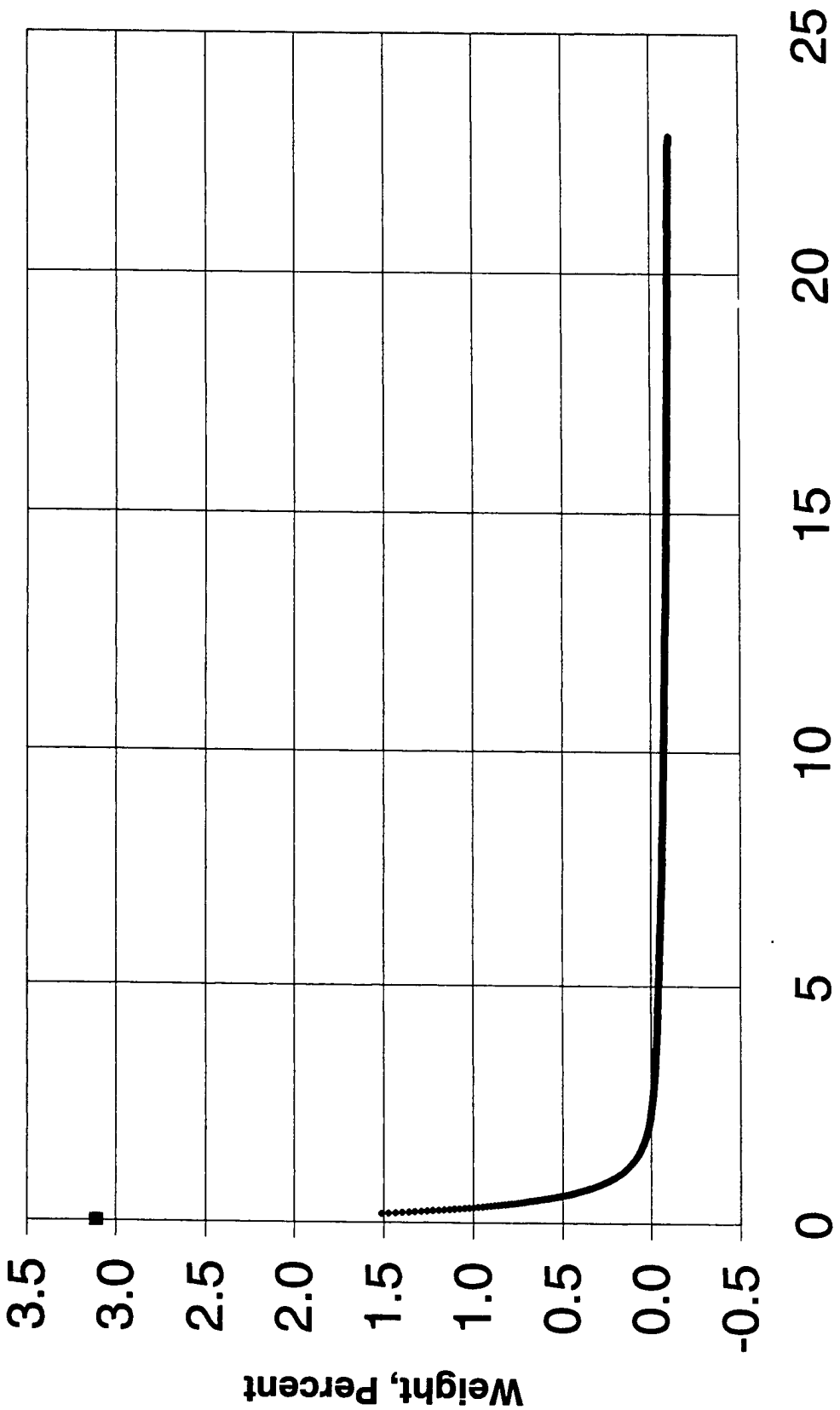


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PEP (0130d)

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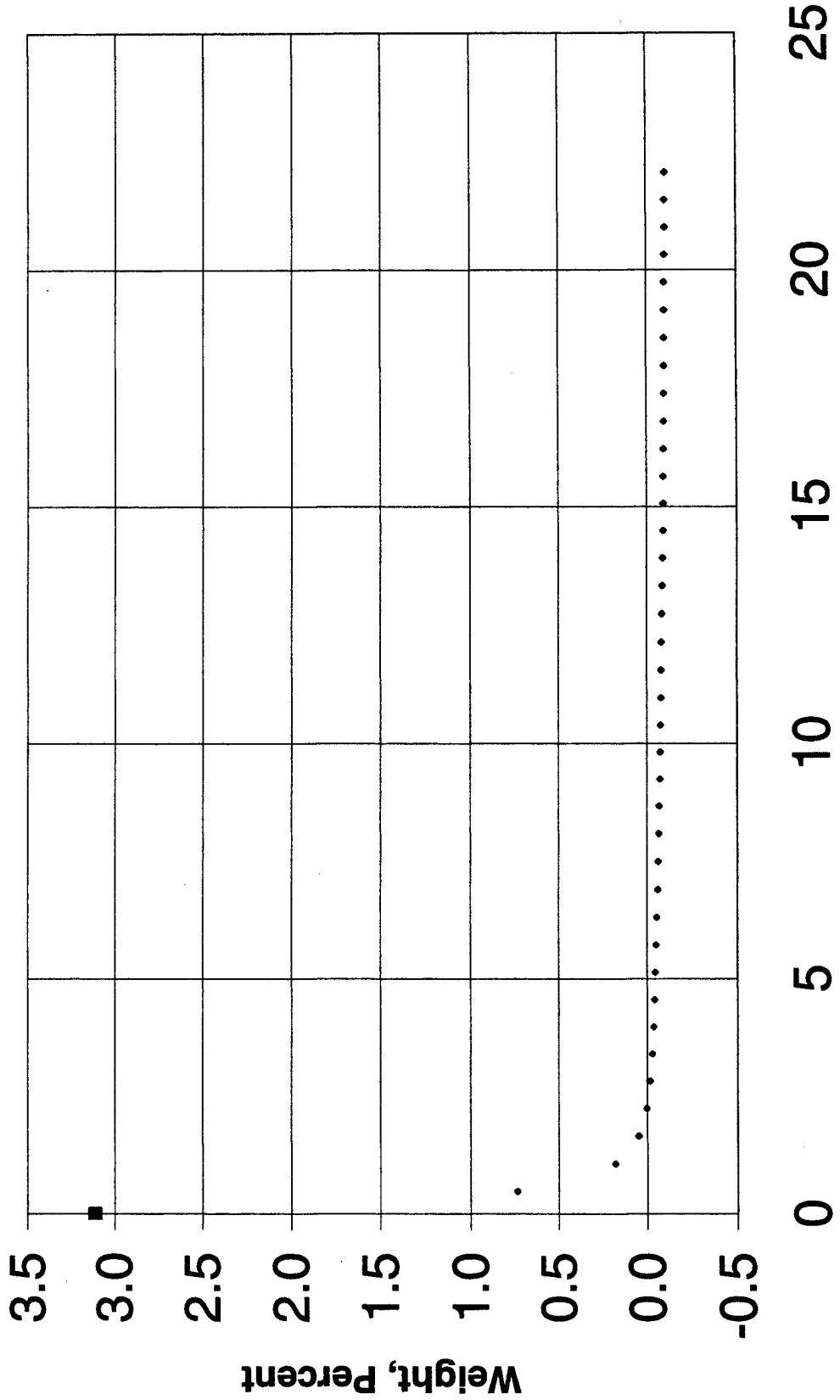

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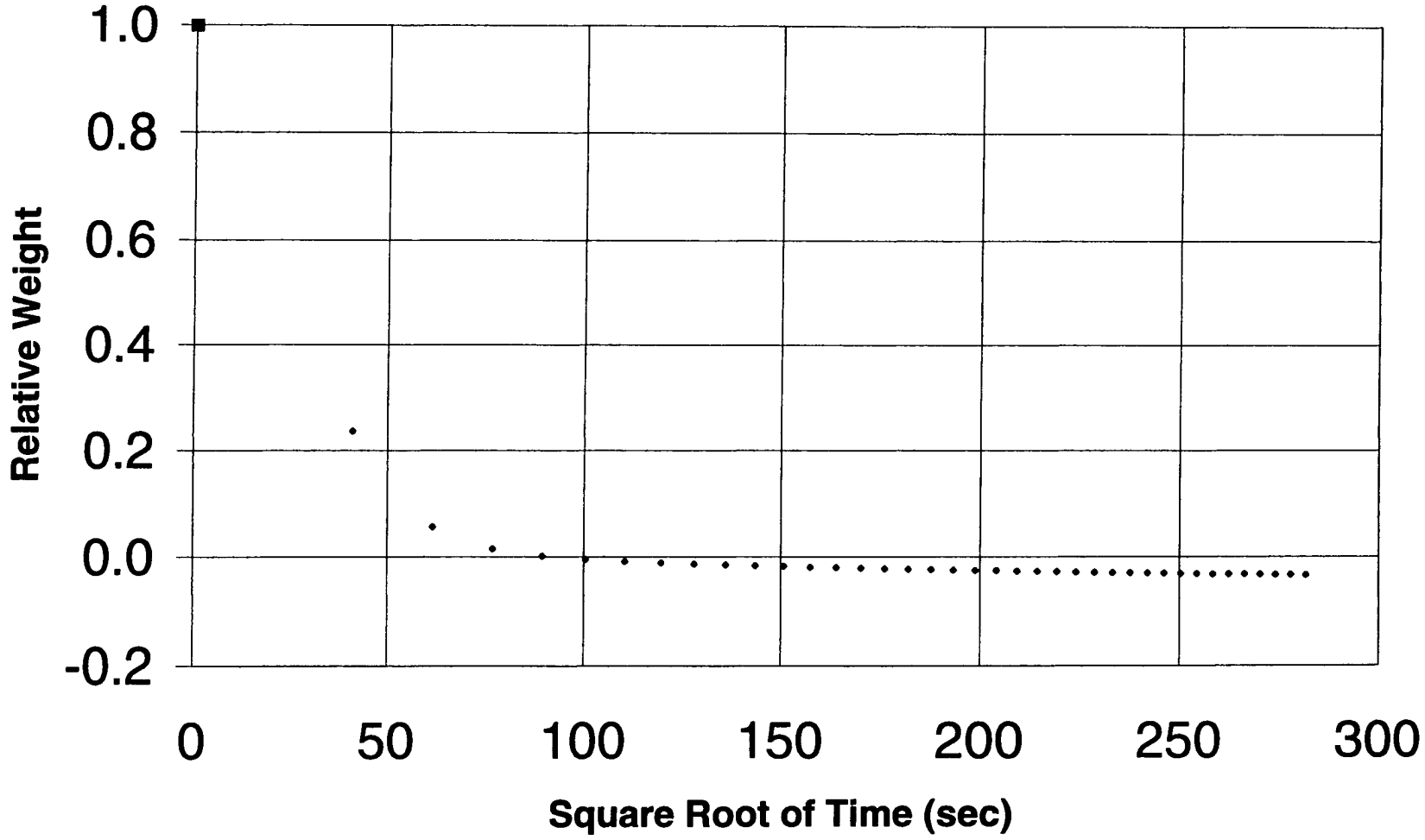

TGA Time, min	Temp., deg C	TGA Wt., mg	TGA Time, sec	Adjusted Time, sec	Adjusted Time, hr	SQRT Adj. Time, sec	Wt. Loss, %	Fractional Wt. Loss	Wt. @ Zero Time, mg	Wt. @ Zero Time, %	TGA Dry Wt., mg	Adjustment to TGA Time, sec	Hardness Scale
A	B	C	D	E	F	G	H	I	J	K	L	M	N
17.430	30.007	114.891	1045.800	1680.800	0.467	41.00	0.737	0.237	117.60	3.112	114.051	635	Shore A
52.461	30.000	114.254	3147.660	3782.660	1.051	61.50	0.178	0.057					
87.495	30.000	114.106	5249.700	5884.700	1.635	76.71	0.048	0.015					Pre Exposure
122.519	30.000	114.056	7351.140	7986.140	2.218	89.37	0.004	0.001	Formulae Used for Analysis of Data				Hardness
157.568	30.000	114.034	9454.080	10089.080	2.803	100.44	-0.015	-0.005	Uppercase letters refer to columns				93.6
192.620	30.000	114.021	11557.200	12192.200	3.387	110.42	-0.026	-0.008	Lowercase n refers to row, beginning with n=4				
227.663	30.000	114.012	13659.780	14294.780	3.971	119.56	-0.034	-0.011	----------				Post Desorption
262.691	30.000	114.006	15761.460	16396.460	4.555	128.05	-0.039	-0.013	Dn = (An * 60)				Hardness
297.733	30.000	114.000	17863.980	18498.980	5.139	136.01	-0.045	-0.014	En = (Dn + M4)				93.9
332.744	30.000	113.995	19964.640	20599.640	5.722	143.53	-0.049	-0.016	Fn = (En / 3600)				
367.764	30.000	113.990	22065.840	22700.840	6.306	150.67	-0.053	-0.017	Gn = SQRT (En)				Change in
402.795	30.000	113.984	24167.700	24802.700	6.890	157.49	-0.059	-0.019	Hn = (((Cn - L4) / L4) * 100)				Hardness, %
437.841	30.000	113.981	26270.460	26905.460	7.474	164.03	-0.061	-0.020	In = ((Cn - L4) / (J4 - L4))				0.32
472.875	30.000	113.978	28372.500	29007.500	8.058	170.32	-0.064	-0.021	K4 = (((J4 - L4) / L4) * 100)				
507.955	30.001	113.974	30477.300	31112.300	8.642	176.39	-0.068	-0.022	N16 = (((N12 - N8) / N8) * 100)				
542.981	30.000	113.970	32578.860	33213.860	9.226	182.25	-0.071	-0.023					
578.016	30.000	113.968	34680.960	35315.960	9.810	187.93	-0.073	-0.023					
613.051	30.000	113.965	36783.060	37418.060	10.394	193.44	-0.075	-0.024	Source binary TA data file : pep0130d.01				
648.086	30.000	113.963	38883.960	39518.960	10.977	198.79	-0.077	-0.025	14 lines in the parameter block				
683.092	30.000	113.961	40985.520	41620.520	11.561	204.01	-0.079	-0.025	3 channels of data				
718.112	30.000	113.958	43086.720	43721.720	12.145	209.10	-0.082	-0.026	----------				
753.136	30.001	113.955	45188.160	45823.160	12.729	214.06	-0.084	-0.027	Run 37				
788.141	30.000	113.953	47288.460	47923.460	13.312	218.91	-0.086	-0.028	Module TGA Aluminum Pans				
823.159	30.001	113.951	49389.540	50024.540	13.896	223.66	-0.088	-0.028	Sample PEP Mask SCO2 0130D Disk				
858.199	30.000	113.949	51491.940	52126.940	14.480	228.31	-0.089	-0.029	Size 115.799 mg				
893.241	30.001	113.947	53594.460	54229.460	15.064	232.87	-0.091	-0.029	Method DESORPTION-Isothermal				
928.271	30.000	113.946	55696.260	56331.260	15.648	237.34	-0.092	-0.030	Operator ws				
963.296	29.999	113.944	57797.760	58432.760	16.231	241.73	-0.094	-0.030	Comment .38"x.04",HP@1400x50,Dry:DS-114.1 M-114.19 TG-114.051 ET:10:35				
998.316	30.000	113.943	59898.960	60533.960	16.815	246.04	-0.095	-0.030	Nsig 3				
1033.356	30.000	113.941	62001.360	62636.360	17.399	250.27	-0.096	-0.031	Sig1 Time (min)				
1068.370	30.000	113.940	64102.200	64737.200	17.983	254.44	-0.097	-0.031	Sig2 Temperature (øC)				
1103.416	30.000	113.938	66204.960	66839.960	18.567	258.53	-0.099	-0.032	Sig3 Weight (mg)				
1138.457	30.000	113.937	68307.420	68942.420	19.151	262.57	-0.100	-0.032	Kcell 1.0000				
1173.515	30.000	113.937	70410.900	71045.900	19.735	266.54	-0.100	-0.032	Date 9-May-00				
1208.562	30.000	113.936	72513.720	73148.720	20.319	270.46	-0.101	-0.032	Time 11:47				
1243.609	30.000	113.934	74616.540	75251.540	20.903	274.32	-0.103	-0.033					
1278.711	30.000	113.934	76722.660	77357.660	21.488	278.13	-0.103	-0.033					
1313.760	30.000	113.932	78825.600	79460.600	22.072	281.89	-0.104	-0.034					

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FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Polystyrene-butadiene PSBR

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	14-1-1	TGA Filename:	psbr143z
Property Test Specification:	ASTM D471/D543		
Material Name:	Polystyrene-butadiene	Material Code:	PSBR
Material Supplier:	Smithers Scientific	Material Class:	SBR
Monomer Source:	DuPont	Base Polymer (Lot. No.):	Unknown
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	1

Pre-Exposure Data

Measured Diameter (mm):	8.61	8.54	8.64	8.63	
Mean Diameter:	8.620		95% Confidence Level (CL):		0.072
Measured Thickness (mils):	40.70	40.60	40.90	40.90	
Mean Thickness:	40.775		95% Confidence Level (CL):		0.239
Initial Sample Weight (mg):	70.370				
Initial Durometer Hardness:	85.8	Scale: SHORE	A		

Sample Exposure Data

Exposure Date:	05/22/00	Time:	14:02:00
Removal Date:	05/22/00	Time:	14:17:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	75.00
Weight Gain (mg):	4.63	Percent Weight Gain:	6.58
Final Durometer Hardness After Desorption:	87.1	Percent Hardness Change:	1.5

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.002	95% CL:	0.0006
Time Lapse Between Sample Exposure and Sample Desorption (sec):			430
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			69.850
Sample Extracted (mg): 0.52	Solubility Corrected for Extractables (mg):		5.15
Sample Extracted (%): 0.74	Solubility Corrected for Extractables (%):		7.32

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm2/sec):	7.8964E-07		
Range Including 0,1 Intercept, Relative Weight Fraction:	1.00 - 0.46		
Linear Range of Desorption, Relative Weight Fraction:	0.60 - 0.46		
Slope: -1.9363E-02	X-axis Intercept:	5.1626E+01	
R Square: 0.99994	Y-axis Intercept:	9.9963E-01	

Low Concentration Diffusion Coefficient (cm2/sec):	9.3694E-11		
Linear Range of Desorption, Relative Weight Fraction:	0.05 - 0.00		
Slope: -2.1092E-04	X-axis Intercept:	3.8201E+02	
R Square: 0.99137	Y-axis Intercept:	8.0573E-02	

Wt. @ Zero Time, mg K 75.00	Wt. @ Zero Time, % L 6.580	Adjustment to TGA Time, sec M 430	Hardness Shore Scale N A
TGA Dry Wt., mg 70.370	Equil. Wt. Of Desorb. Sample 69.85	Min. Wt. Used For FDC, mg. 69.850	Pre Exposure Hardness 85.8
High Conc. DC, cm2/sec 7.8964E-07	Low Conc. DC, cm2/sec 9.3694E-11	Total Liquid Sorbed, mg. 4.630	Post Desorption Hardness 87.1
R Square 0.99994	R Square 0.99137		Change in Hardness, % 1.5
X Intercept 51.63	X Intercept 382.0		Mean Thickness, cm. 0.1036
Y Intercept 0.99963	Y Intercept 0.08057		
Y Intercept as Wt., mg. 74.972	X Intercept as Time, hrs. 40.5	X Intercept as Time, min. 243.2	**psbr143z** X Intercept as Time, days 1.7
		Max. TGA Wt., (orig data file) 72.951	TGA Wt. At 20 min. Adjustment 71.683

TEMPERATURE STATISTICS

Column1	
Mean	30.00189014
Standard Error	0.000306054
Median	30.002
Mode	30.002
Standard Deviation	0.017544129
Sample Variance	0.000307796
Kurtosis	818.301557
Skewness	-22.99612249
Range	0.845
Minimum	29.327
Maximum	30.172
Sum	98586.211
Count	3286
Confidence Level(95.0%)	0.000600077

Sorption @ 7-12 min., mg 2.58	Sorption @ 20 min., mg 1.31
Sorption @ 7-12 min., % 3.67	Sorption @ 20 min., % 1.87
Rel. Error (%) of 7-12 min. Sorp. -44.3	Rel. Error (%) of 20 min. Sorp -71.6

DIAMETER STATISTICS

	Column1	
	Mean	8.605
	Standard Error	0.02254625
	Median	8.62
	Mode	#N/A
	Standard Deviation	0.0450925
	Sample Variance	0.00203333
	Kurtosis	2.41709218
	Skewness	-1.5705422
	Range	0.1
	Minimum	8.54
	Maximum	8.64
ND/value	Sum	34.42
ND/value	Count	4
A/D	Confidence Level(95.0%)	0.07175229

THICKNESS STATISTICS

	Column1	
	Mean	40.775
	Standard Error	0.075
	Median	40.8
	Mode	40.9
	Standard Deviation	0.15
	Sample Variance	0.0225
	Kurtosis	-3.9012346
Unknown	Skewness	-0.3703704
psbr143z	Range	0.3
	Minimum	40.6
	Maximum	40.9
	Sum	163.1
	Count	4
	Confidence Level(95.0%)	0.2386837

HIGH CONCENTRATION DIFFUSION COEFFICIENT

psbr143z

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999968753
R Square	0.999937507
Adjusted R Square	0.999932299
Standard Error	0.00111621
Observations	14

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.239229675	0.239229675	192009.759	1.34372E-26
Residual	12	1.49511E-05	1.24592E-06		
Total	13	0.239244627			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.999631372	0.001060248	942.8274908	1.3651E-30	0.997321289	1.001941455
X Variable 1	-0.019362959	4.41886E-05	-438.1891819	1.3437E-26	-0.019459237	-0.01926668

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

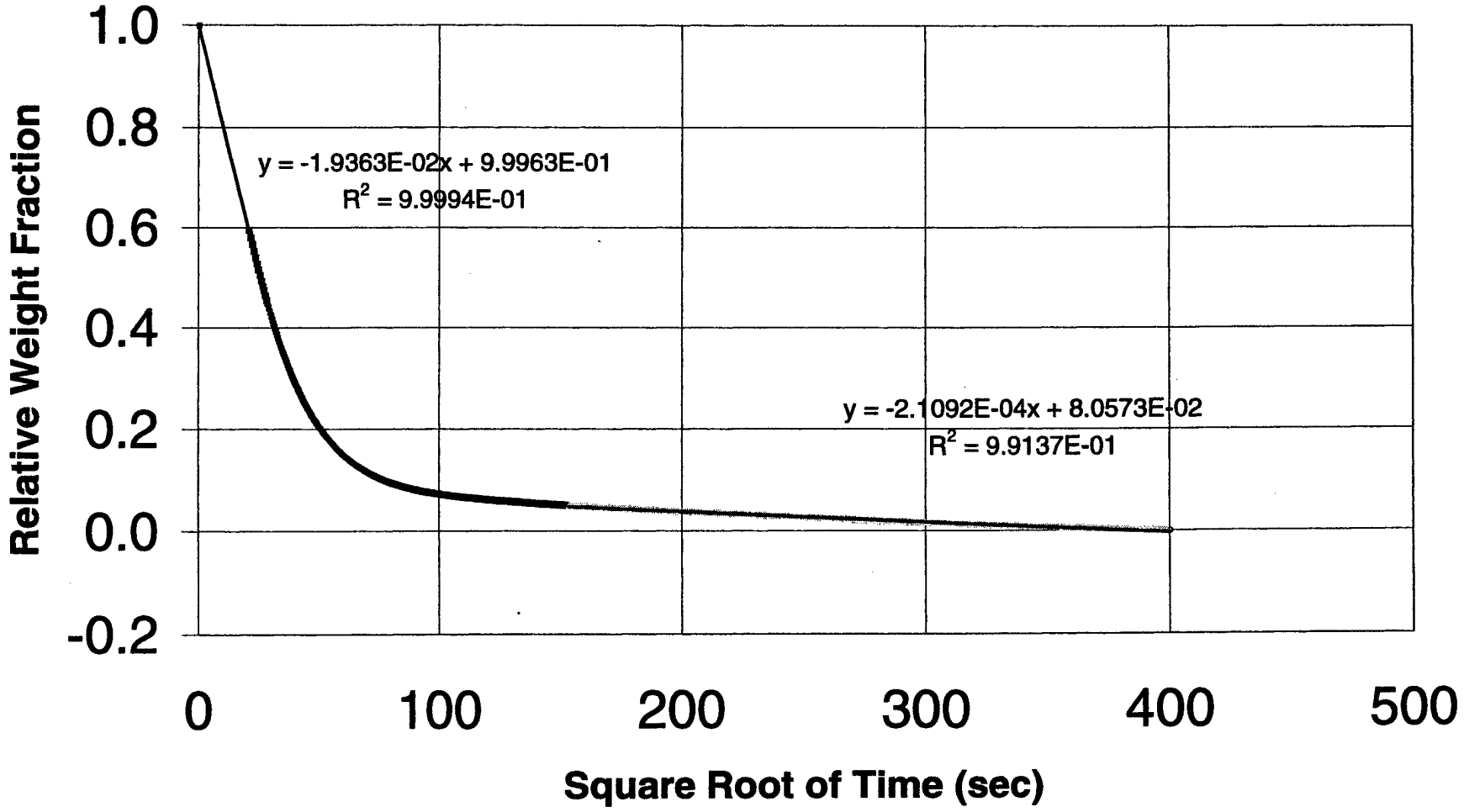
Regression Statistics	
Multiple R	0.995673175
R Square	0.991365072
Adjusted R Square	0.991361632
Standard Error	0.001147306
Observations	2512

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.37932119	0.37932119	288169.893	0
Residual	2510	0.003303941	1.31631E-06		
Total	2511	0.38262513			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.080573277	0.000101198	796.1964679	0	0.080374838	0.080771717
X Variable 1	-0.000210918	3.92907E-07	-536.81458	0	-0.000211689	-0.000210148

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PSBR (143z)



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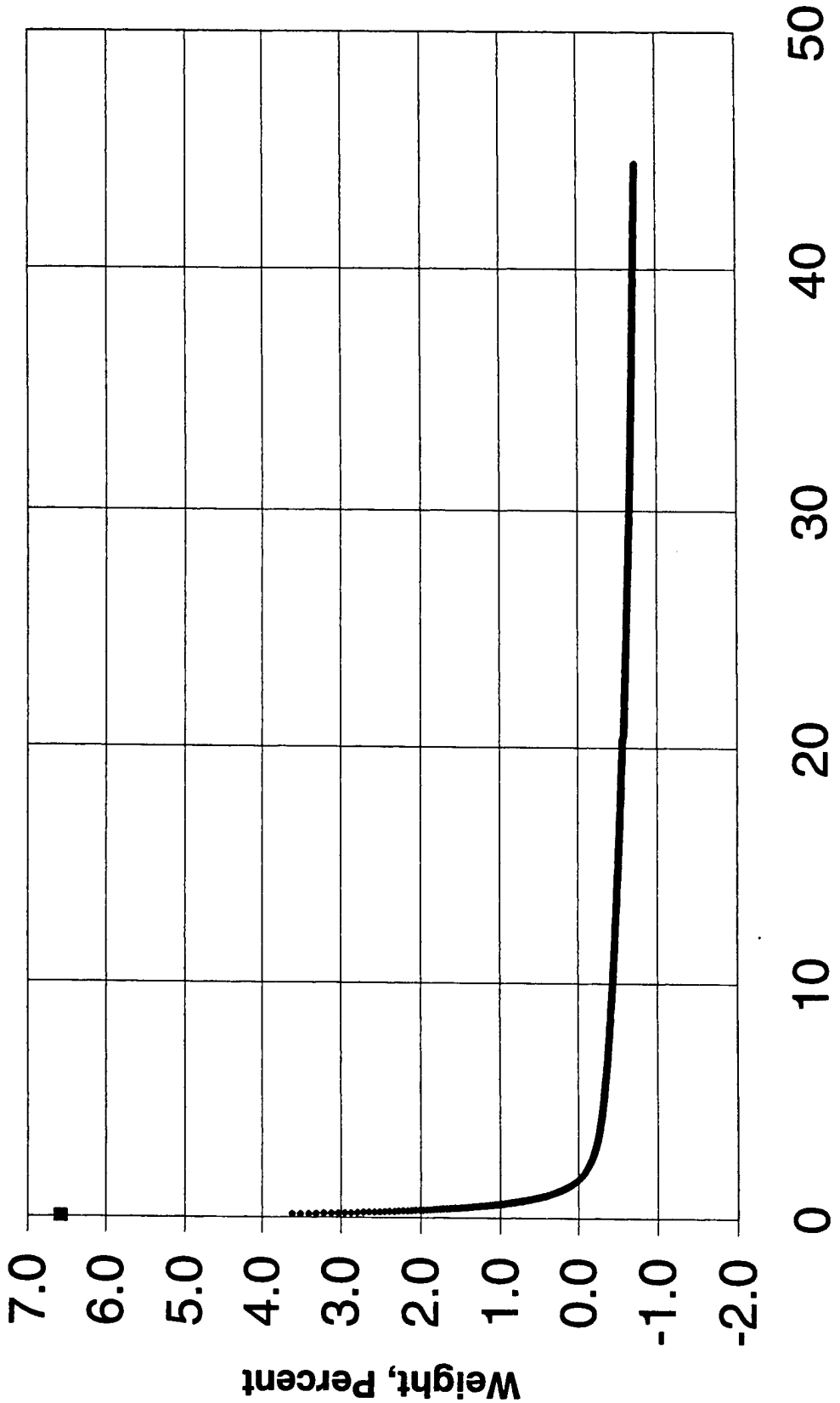

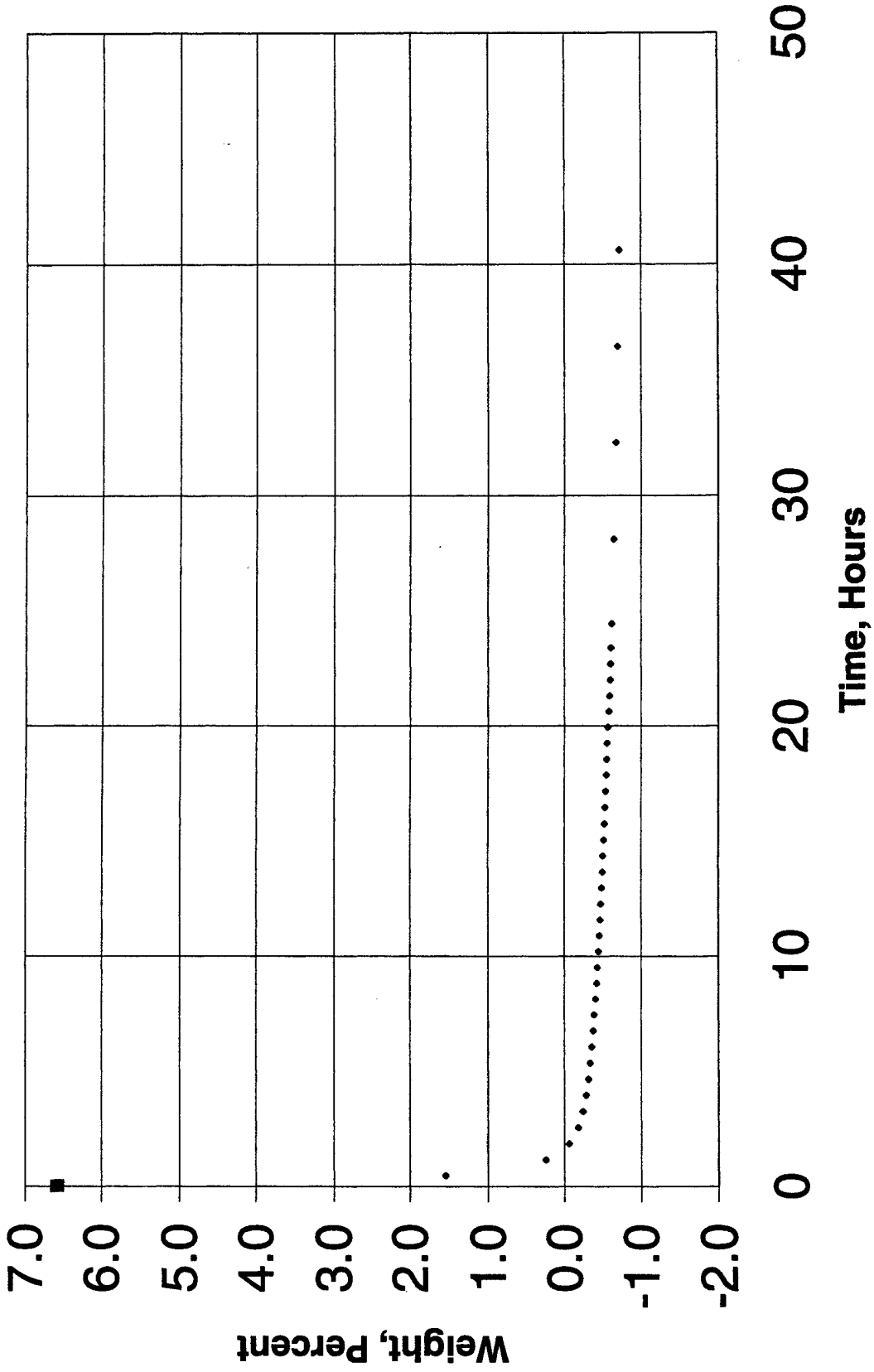

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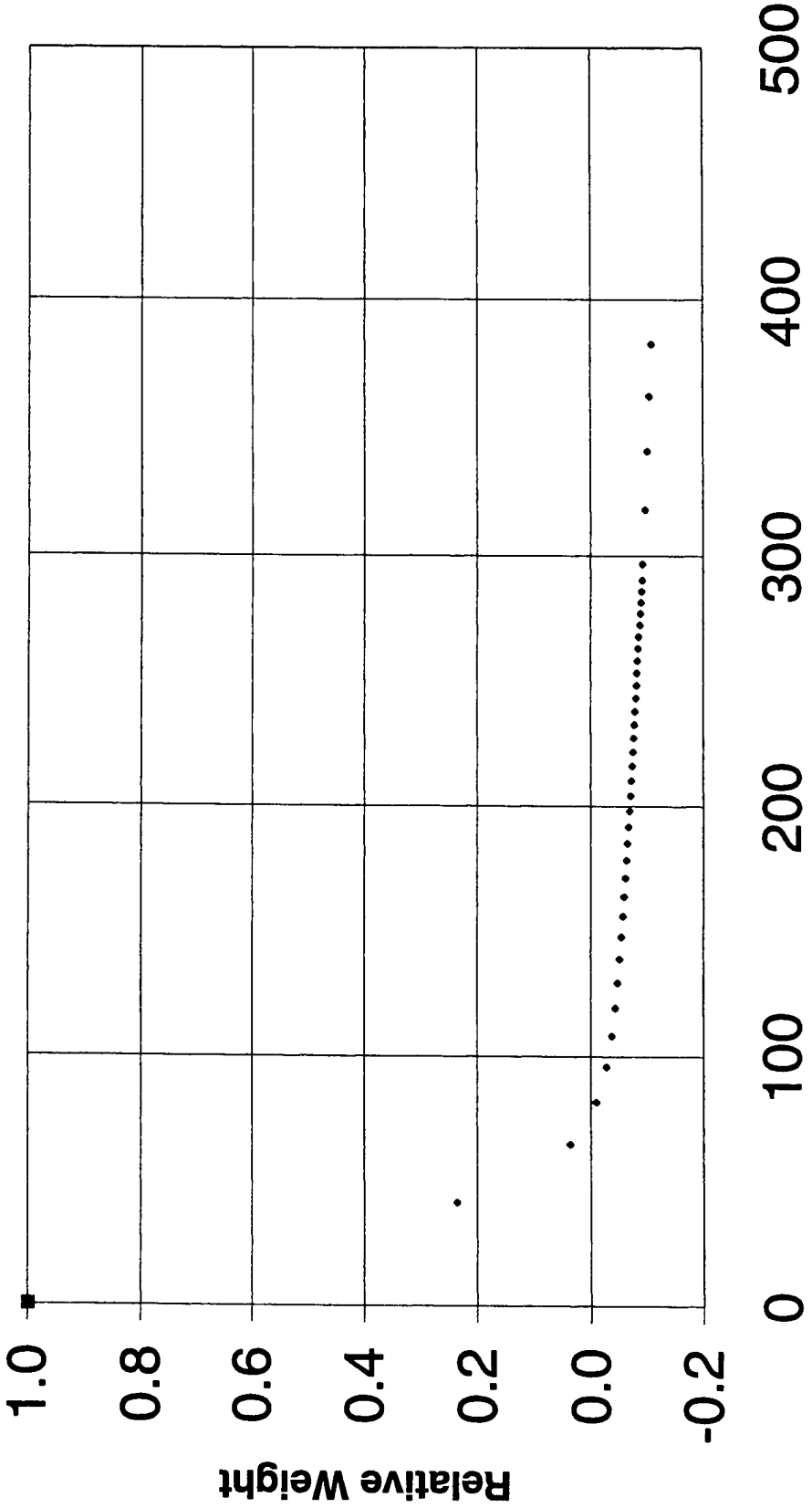

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PSBR (143z)

TGA Time, min	Temp., deg C	TGA Wt., mg	TGA Time, sec	Adjusted Time, sec	Adjusted Time, hr	SQRT Adj. Time, sec	Wt. Loss, %	Fractional Wt. Loss	Wt. @ Zero Time, mg	Wt. @ Zero Time, %	TGA Dry Wt., mg	Adjustment to TGA Time, sec	Hardness Scale
A	B	C	D	E	F	G	H	I	J	K	L	M	N
20.762	29.992	71.461	1245.720	1675.720	0.465	40.94	1.552	0.236	75.00	6.581	70.369	430	Shore A
62.452	30.000	70.540	3747.120	4177.120	1.160	64.63	0.243	0.037					
104.133	30.001	70.326	6247.980	6677.980	1.855	81.72	-0.062	-0.009					Pre Exposure Hardness
145.831	30.002	70.242	8749.860	9179.860	2.550	95.81	-0.180	-0.027	Formulae Used for Analysis of Data				85.8
187.585	30.001	70.199	11255.100	11685.100	3.246	108.10	-0.242	-0.037	Uppercase letters refer to columns				
229.334	30.001	70.171	13760.040	14190.040	3.942	119.12	-0.281	-0.043	Lowercase n refers to row, beginning with n=4				
271.057	30.001	70.151	16263.420	16693.420	4.637	129.20	-0.310	-0.047	----------				Post Desorption Hardness
312.798	30.001	70.134	18767.880	19197.880	5.333	138.56	-0.334	-0.051	Dn = (An * 60)				87.1
354.499	30.002	70.120	21269.940	21699.940	6.028	147.31	-0.354	-0.054	En = (Dn + M4)				
396.221	30.001	70.107	23773.260	24203.260	6.723	155.57	-0.372	-0.057	Fn = (En / 3600)				
437.964	30.002	70.096	26277.840	26707.840	7.419	163.43	-0.388	-0.059	Gn = SQRT (En)				Change in Hardness, %
479.741	30.002	70.086	28784.460	29214.460	8.115	170.92	-0.403	-0.061	Hn = (((Cn - L4) / L4) * 100)				1.52
521.439	30.002	70.076	31286.340	31716.340	8.810	178.09	-0.416	-0.063	In = ((Cn - L4) / (J4 - L4))				
563.125	30.002	70.067	33787.500	34217.500	9.505	184.98	-0.429	-0.065	K4 = (((J4 - L4) / L4) * 100)				
604.814	30.002	70.059	36288.840	36718.840	10.200	191.62	-0.441	-0.067	N16 = (((N12 – N8) /N8) * 100)				
646.521	30.003	70.051	38791.260	39221.260	10.895	198.04	-0.452	-0.069					
688.215	30.003	70.043	41292.900	41722.900	11.590	204.26	-0.463	-0.070					
729.891	30.002	70.036	43793.460	44223.460	12.284	210.29	-0.473	-0.072	Source binary TA data file : psbr143z.01				
771.627	30.002	70.029	46297.620	46727.620	12.980	216.17	-0.483	-0.073	14 lines in the parameter block				
813.368	30.002	70.023	48802.080	49232.080	13.676	221.88	-0.492	-0.075	3 channels of data				
855.073	30.002	70.016	51304.380	51734.380	14.371	227.45	-0.501	-0.076	----------				
896.767	30.001	70.010	53806.020	54236.020	15.066	232.89	-0.510	-0.078	Run 44				
938.465	30.002	70.004	56307.900	56737.900	15.761	238.20	-0.518	-0.079	Module TGA Aluminum Pans				
980.191	30.002	69.998	58811.460	59241.460	16.456	243.40	-0.527	-0.080	Sample PSBR POLY(STYRENE-BUTADIENE)				
1021.926	30.002	69.993	61315.560	61745.560	17.152	248.49	-0.534	-0.081	Size 72.951 mg				
1063.657	30.001	69.988	63819.420	64249.420	17.847	253.47	-0.542	-0.082	Method DESORPTION-Isothermal				
1105.386	30.003	69.983	66323.160	66753.160	18.543	258.37	-0.549	-0.083	Operator BSI				
1147.072	30.002	69.977	68824.320	69254.320	19.237	263.16	-0.556	-0.085	Comment .339"x.041",HP@1400x50,Dry:DS-			M-70.34 TG-70.369 ET: 7:10	
1188.758	30.001	69.972	71325.480	71755.480	19.932	267.87	-0.564	-0.086	Nsig 3				
1230.454	30.004	69.961	73827.240	74257.240	20.627	272.50	-0.579	-0.088	Sig1 Time (min)				
1272.151	30.004	69.956	76329.060	76759.060	21.322	277.05	-0.587	-0.089	Sig2 Temperature (øC)				
1313.836	30.003	69.951	78830.160	79260.160	22.017	281.53	-0.594	-0.090	Sig3 Weight (mg)				
1355.529	30.004	69.947	81331.740	81761.740	22.712	285.94	-0.600	-0.091	Kcell 1.0000				
1397.222	30.003	69.943	83833.320	84263.320	23.406	290.28	-0.605	-0.092	Date 22-May-00				
1460.196	30.003	69.937	87611.760	88041.760	24.456	296.72	-0.614	-0.093	Time 14:25				
1678.928	30.003	69.917	100735.680	101165.680	28.102	318.07	-0.643	-0.098					
1928.934	30.003	69.897	115736.040	116166.040	32.268	340.83	-0.671	-0.102					
2178.936	30.003	69.880	130736.160	131166.160	36.435	362.17	-0.695	-0.106					
2428.937	30.003	69.864	145736.220	146166.220	40.602	382.32	-0.718	-0.109					

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FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Polyisoprene PIP

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	09-1-1	TGA Filename:	pip0131d
Property Test Specification:	ASTM D471/D543		
Material Name:	Polyisoprene	Material Code:	PIP
Material Supplier:	Smithers Scientific	Material Class:	IR
Monomer Source:	Dupont	Base Polymer (Lot. No.):	Unknown
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	1

Pre-Exposure Data

Measured Diameter (mm):		9.81	9.79	9.85	9.83	
Mean Diameter:	9.820			95% Confidence Level (CL):		0.041
Measured Thickness (mils):		41.00	41.00	41.00	41.00	
Mean Thickness:	41.000			95% Confidence Level (CL):		0.000
Initial Sample Weight (mg):		83.660				
Initial Durometer Hardness:		66.9	Scale: SHORE		A	

Sample Exposure Data

Exposure Date:	05/10/00	Time:	11:06:00
Removal Date:	05/10/00	Time:	11:21:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	86.50
Weight Gain (mg):	2.84	Percent Weight Gain:	3.39
Final Durometer Hardness After Desorption:	68.7	Percent Hardness Change:	2.7

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.001	95% CL:	0.0008
Time Lapse Between Sample Exposure and Sample Desorption (sec):			900
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			83.050
Sample Extracted (mg): 0.61	Solubility Corrected for Extractables (mg):		3.45
Sample Extracted (%): 0.73	Solubility Corrected for Extractables (%):		4.12

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm2/sec):			8.1549E-07
Range Including 0,1 Intercept, Relative Weight Fraction:			1.00 - 0.30
Linear Range of Desorption, Relative Weight Fraction:			0.43 - 0.30
Slope:	-1.9569E-02	X-axis Intercept:	5.1365E+01
R Square:	0.99817	Y-axis Intercept:	1.0052E+00

Low Concentration Diffusion Coefficient (cm2/sec):			1.2030E-10
Linear Range of Desorption, Relative Weight Fraction:			0.05 - 0.00
Slope:	-2.3768E-04	X-axis Intercept:	2.9640E+02
R Square:	0.99247	Y-axis Intercept:	7.0450E-02

Wt. @ Zero Time, mg K 86.50	Wt. @ Zero Time, % L 3.395	Adjustment to TGA Time, sec M 900	Hardness Shore Scale N A
TGA Dry Wt., mg 83.660	Equil. Wt. Of Desorb. Sample 83.05	Min. Wt. Used For FDC, mg. 83.050	Pre Exposure Hardness 66.9
High Conc. DC, cm2/sec 8.1549E-07	Low Conc. DC, cm2/sec 1.2030E-10	Total Liquid Sorbed, mg. 2.840	Post Desorption Hardness 68.7
R Square 0.99817	R Square 0.99247		Change in Hardness, % 2.7
X Intercept 51.37	X Intercept 296.4		Mean Thickness, cm. 0.1041
Y Intercept 1.00519	Y Intercept 0.07045		
Y Intercept as Wt., mg. 86.949	X Intercept as Time, hrs. 24.4	X Intercept as Time, min. 146.4	**pip0131d** X Intercept as Time, days 1.0
		Max. TGA Wt., (orig data file) 84.564	TGA Wt. At 20 min. Adjustment 84.159
		Sorption @ 7-12 min., mg 0.90	Sorption @ 20 min., mg 0.50
		Sorption @ 7-12 min., % 1.08	Sorption @ 20 min., % 0.60
		Rel. Error (%) of 7-12 min. Sorp. -68.2	Rel. Error (%) of 20 min. Sorp -82.4

TEMPERATURE STATISTICS

Column1	
Mean	30.00092176
Standard Error	0.000420946
Median	30
Mode	30
Standard Deviation	0.02272328
Sample Variance	0.000516347
Kurtosis	275.3486451
Skewness	-5.327203032
Range	0.855
Minimum	29.449
Maximum	30.304
Sum	87422.686
Count	2914
Confidence Level(95.0%)	0.000825382

DIAMETER STATISTICS

	Column1	
	Mean	9.82
	Standard Error	0.01290994
	Median	9.82
	Mode	#N/A
	Standard Deviation	0.02581989
	Sample Variance	0.00066667
	Kurtosis	-1.2
	Skewness	-1.858E-13
	Range	0.06
	Minimum	9.79
	Maximum	9.85
ND/value	Sum	39.28
ND/value	Count	4
A/D	Confidence Level(95.0%)	0.04108524

THICKNESS STATISTICS

	Column1	
	Mean	41
	Standard Error	0
	Median	41
	Mode	41
	Standard Deviation	0
	Sample Variance	0
	Kurtosis	#DIV/0!
Unknown	Skewness	#DIV/0!
pip0131d	Range	0
	Minimum	41
	Maximum	41
	Sum	164
	Count	4
	Confidence Level(95.0%)	0

HIGH CONCENTRATION DIFFUSION COEFFICIENT

pip0131d

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999086432
R Square	0.998173699
Adjusted R Square	0.998033214
Standard Error	0.00761116
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.411603256	0.411603256	7105.21296	3.445E-19
Residual	13	0.000753087	5.79298E-05		
Total	14	0.412356343			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	1.005190268	0.007455556	134.8243179	7.7337E-22	0.989083521	1.021297014
X Variable 1	-0.019569374	0.000232161	-84.29242527	3.445E-19	-0.020070926	-0.019067821

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

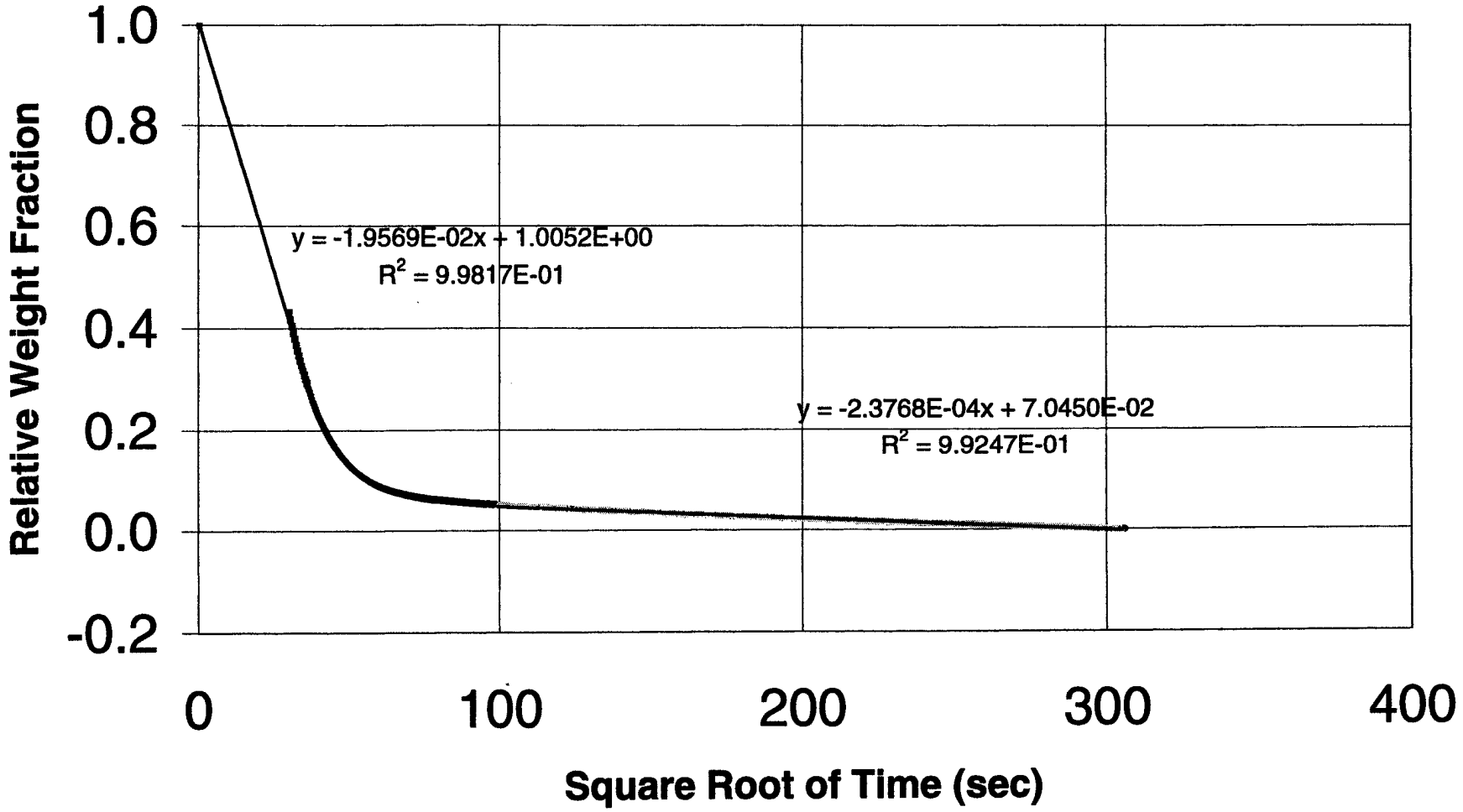
Regression Statistics	
Multiple R	0.996228405
R Square	0.992471035
Adjusted R Square	0.99246815
Standard Error	0.001134207
Observations	2612

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.442596405	0.442596405	344051.2	0
Residual	2610	0.003357572	1.28643E-06		
Total	2611	0.445953977			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.070450436	8.98162E-05	784.3847471	0	0.070274318	0.070626555
X Variable 1	-0.000237683	4.05216E-07	-586.5587778	0	-0.000238478	-0.000236888

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PIP (0131d)



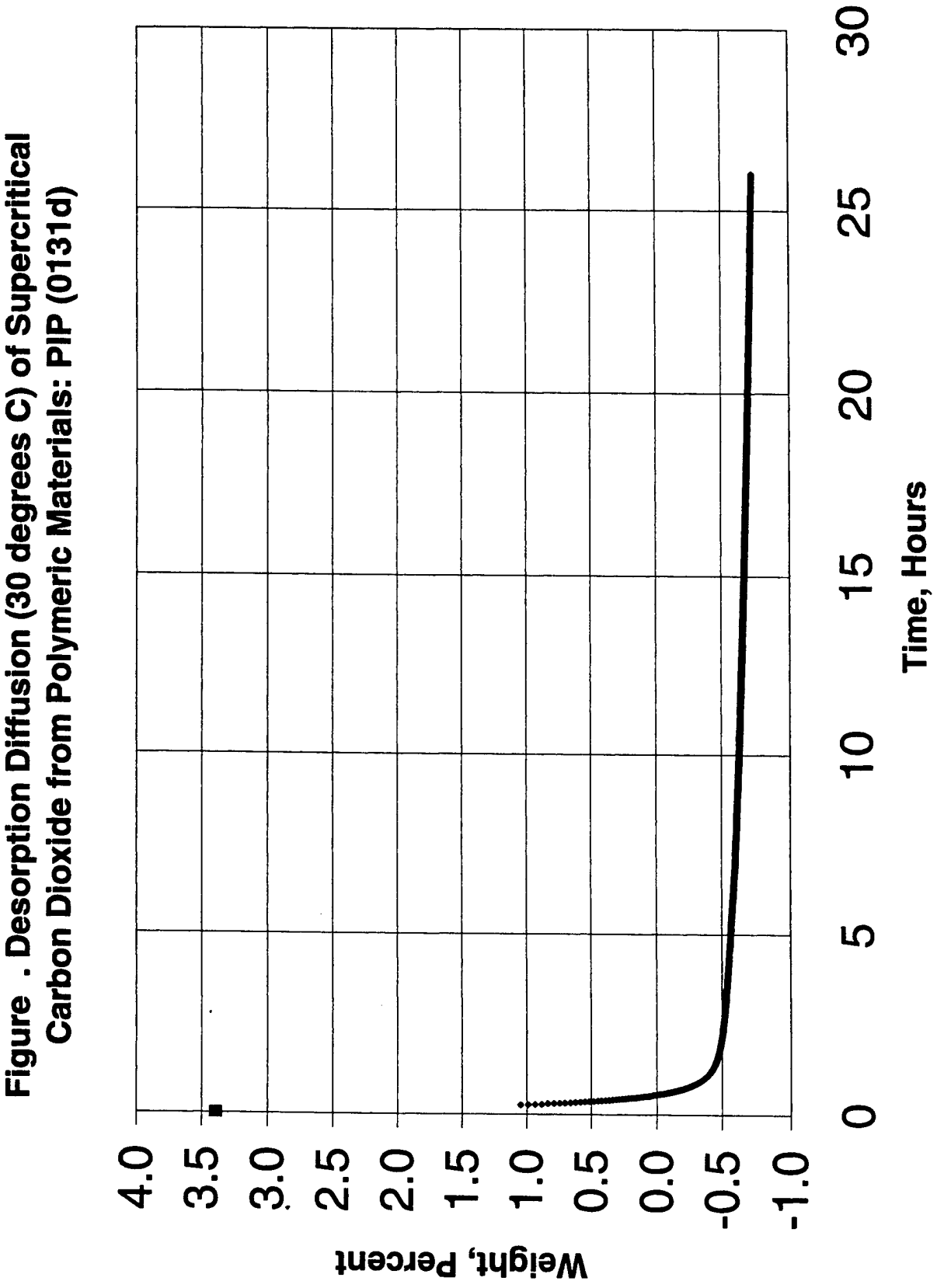
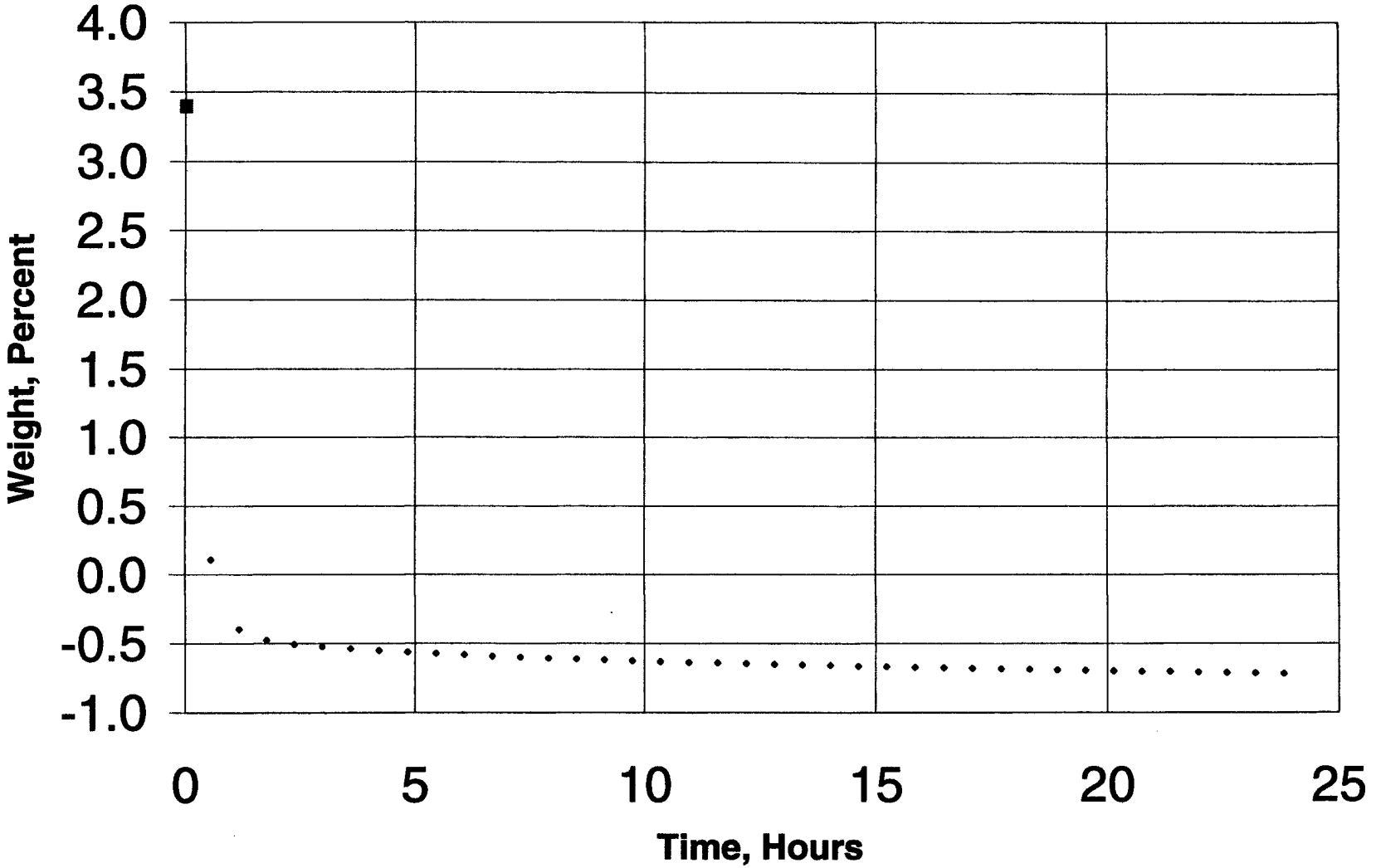


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PIP (0131d)
Weight, Percent
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
0
5
10
15
20
25
30
Time, Hours

Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PIP (0131d)



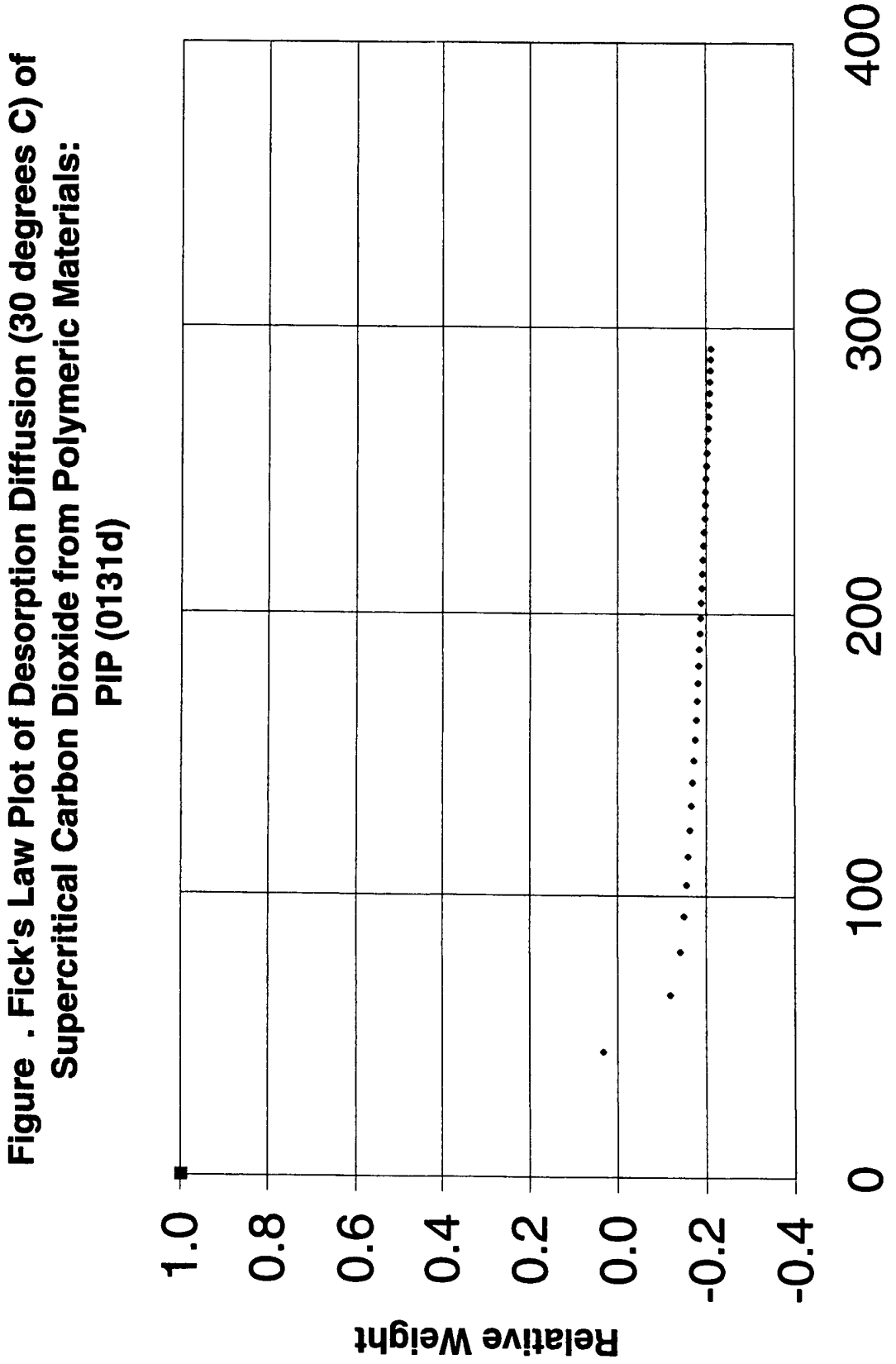


Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PIP (0131d)
Relative Weight
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
0
100
200
300
400
Square Root of Real Time (sec)

TGA Time, min	Temp., deg C	TGA Wt., mg	TGA Time, sec	Adjusted Time, sec	Adjusted Time, hr	SQRT Adj. Time, sec	Wt. Loss, %	Fractional Wt. Loss	Wt. @ Zero Time, mg	Wt. @ Zero Time, %	TGA Dry Wt., mg	Adjustment to TGA Time, sec	Hardness Scale
A	B	C	D	E	F	G	H	I	J	K	L	M	N
18.250	30.015	83.750	1095.000	1995.000	0.554	44.67	0.110	0.032	86.50	3.397	83.658	900	Shore A
54.918	30.000	83.324	3295.080	4195.080	1.165	64.77	-0.400	-0.118					
91.621	30.000	83.258	5497.260	6397.260	1.777	79.98	-0.478	-0.141					Pre Exposure
128.315	30.000	83.235	7698.900	8598.900	2.389	92.73	-0.506	-0.149	Formulae Used for Analysis of Data				Hardness
165.002	30.000	83.220	9900.120	10800.120	3.000	103.92	-0.524	-0.154	Uppercase letters refer to columns				66.9
201.757	30.000	83.208	12105.420	13005.420	3.613	114.04	-0.538	-0.158	Lowercase n refers to row, beginning with n=4				
238.481	30.000	83.198	14308.860	15208.860	4.225	123.32	-0.550	-0.162	----------				Post Desorption
275.172	30.000	83.188	16510.320	17410.320	4.836	131.95	-0.561	-0.165	Dn = (An * 60)				Hardness
311.900	30.000	83.180	18714.000	19614.000	5.448	140.05	-0.571	-0.168	En = (Dn + M4)				68.7
348.605	30.004	83.172	20916.300	21816.300	6.060	147.70	-0.582	-0.171	Fn = (En / 3600)				
385.321	30.006	83.162	23119.260	24019.260	6.672	154.98	-0.592	-0.174	Gn = SQRT (En)				Change in
422.032	30.001	83.156	25321.920	26221.920	7.284	161.93	-0.600	-0.177	Hn = (((Cn - L4) / L4) * 100)				Hardness, %
458.812	30.001	83.150	27528.720	28428.720	7.897	168.61	-0.607	-0.179	In = ((Cn - L4) / (J4 - L4))				2.69
495.545	30.001	83.146	29732.700	30632.700	8.509	175.02	-0.613	-0.180	K4 = (((J4 - L4) / L4) * 100)				
532.225	30.001	83.140	31933.500	32833.500	9.120	181.20	-0.619	-0.182	N16 = (((N12 - N8) / N8) * 100)				
568.907	30.001	83.135	34134.420	35034.420	9.732	187.17	-0.625	-0.184					
605.628	30.001	83.130	36337.680	37237.680	10.344	192.97	-0.631	-0.186					
642.341	30.001	83.126	38540.460	39440.460	10.956	198.60	-0.636	-0.187	Source binary TA data file : pip0131d.01				
679.025	30.000	83.122	40741.500	41641.500	11.567	204.06	-0.641	-0.189	14 lines in the parameter block				
715.714	30.000	83.118	42942.840	43842.840	12.179	209.39	-0.645	-0.190	3 channels of data				
752.404	30.000	83.114	45144.240	46044.240	12.790	214.58	-0.650	-0.191	----------				
789.094	30.001	83.111	47345.640	48245.640	13.402	219.65	-0.654	-0.193	Run 38				
825.803	30.000	83.107	49548.180	50448.180	14.013	224.61	-0.659	-0.194	Module TGA Aluminum Pans				
862.513	30.000	83.103	51750.780	52650.780	14.625	229.46	-0.663	-0.195	Sample PIP Mask SCO2 0131D Disk				
899.213	30.000	83.099	53952.780	54852.780	15.237	234.21	-0.668	-0.197	Size 84.564 mg				
935.920	30.000	83.096	56155.200	57055.200	15.849	238.86	-0.672	-0.198	Method DESORPTION-Isothermal				
972.639	30.000	83.093	58358.340	59258.340	16.461	243.43	-0.676	-0.199	Operator ws				
1009.323	30.000	83.090	60559.380	61459.380	17.072	247.91	-0.680	-0.200	Comment .39"x.043,HP@1400x50,Dry:DS-83.5 M-83.53 TG-83.658 ET:				
1046.022	30.000	83.086	62761.320	63661.320	17.684	252.31	-0.684	-0.201	Nsig 3				
1082.784	30.000	83.083	64967.040	65867.040	18.296	256.65	-0.687	-0.202	Sig1 Time (min)				
1119.531	30.000	83.080	67171.860	68071.860	18.909	260.91	-0.691	-0.203	Sig2 Temperature (øC)				
1156.260	30.000	83.077	69375.600	70275.600	19.521	265.10	-0.694	-0.204	Sig3 Weight (mg)				
1192.959	30.000	83.074	71577.540	72477.540	20.133	269.22	-0.699	-0.206	Kcell 1.0000				
1229.672	30.000	83.071	73780.320	74680.320	20.745	273.28	-0.702	-0.207	Date 10-May-00				
1266.349	30.000	83.068	75980.940	76880.940	21.356	277.27	-0.705	-0.207	Time 11:36				
1303.051	30.000	83.066	78183.060	79083.060	21.968	281.22	-0.708	-0.208					
1339.793	30.000	83.063	80387.580	81287.580	22.580	285.11	-0.712	-0.210					
1376.515	30.001	83.060	82590.900	83490.900	23.192	288.95	-0.715	-0.210					
1413.197	30.000	83.057	84791.820	85691.820	23.803	292.73	-0.718	-0.211					

Blank

FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Polytetrafluoroethylene-propylene TFEP

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	16-1-1	TGA Filename:	tfep153z
Property Test Specification:	ASTM D471/D543		
Material Name:	Polytetrafluoroethylene-propylene	Material Code:	TFEP
Material Supplier:	Smithers Scientific	Material Class:	FEPM
Monomer Source:	Xenox Corp.	Base Polymer (Lot. No.):	Aflas
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	1

Pre-Exposure Data

Measured Diameter (mm):	8.48	8.51	8.57	8.47	
Mean Diameter:	8.495		95% Confidence Level (CL):		0.072
Measured Thickness (mils):	37.80	37.90	37.80	37.90	
Mean Thickness:	37.850		95% Confidence Level (CL):		0.092
Initial Sample Weight (mg):	86.660				
Initial Durometer Hardness:	91.7	Scale: SHORE		A	

Sample Exposure Data

Exposure Date:	06/01/00	Time:	10:51:00
Removal Date:	06/01/00	Time:	11:06:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	88.60
Weight Gain (mg):	1.94	Percent Weight Gain:	2.24
Final Durometer Hardness After Desorption:	91.2	Percent Hardness Change:	-0.5

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.003	95% CL:	0.0007
Time Lapse Between Sample Exposure and Sample Desorption (sec):			435
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			86.530
Sample Extracted (mg):	0.13	Solubility Corrected for Extractables (mg):	2.07
Sample Extracted (%):	0.15	Solubility Corrected for Extractables (%):	2.39

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm2/sec):			2.2477E-07
Range Including 0,1 Intercept, Relative Weight Fraction:			1.00 - 0.60
Linear Range of Desorption, Relative Weight Fraction:			0.76 - 0.60
Slope:	-1.1129E-02	X-axis Intercept:	8.9797E+01
R Square:	0.99997	Y-axis Intercept:	9.9935E-01

Low Concentration Diffusion Coefficient (cm2/sec):			1.5448E-10
Linear Range of Desorption, Relative Weight Fraction:			0.03 - 0.00
Slope:	-2.9175E-04	X-axis Intercept:	2.8372E+02
R Square:	0.94893	Y-axis Intercept:	8.2775E-02

Wt. @ Zero Time, mg K 88.60	Wt. @ Zero Time, % L 2.239	Adjustment to TGA Time, sec M 435	Hardness Shore Scale N A
TGA Dry Wt., mg 86.660	Equil. Wt. Of Desorb. Sample 86.53	Min. Wt. Used For FDC, mg. 86.530	Pre Exposure Hardness 91.7
High Conc. DC, cm2/sec 2.2477E-07	Low Conc. DC, cm2/sec 1.5448E-10	Total Liquid Sorbed, mg. 1.940	Post Desorption Hardness 91.2
R Square 0.99997	R Square 0.94893		Change in Hardness, % -0.5
X Intercept 89.80	X Intercept 283.7		Mean Thickness, cm. 0.0961
Y Intercept 0.99935	Y Intercept 0.08277		**tfep153z**
Y Intercept as Wt., mg. 88.543	X Intercept as Time, hrs. 22.4	X Intercept as Time, min. 134.2	X Intercept as Time, days 0.9
		Max. TGA Wt., (orig data file) 88.120	TGA Wt. At 20 min. Adjustment 87.799
		Sorption @ 7-12 min., mg 1.46	Sorption @ 20 min., mg 1.14
		Sorption @ 7-12 min., % 1.68	Sorption @ 20 min., % 1.31
		Rel. Error (%) of 7-12 min. Sorp. -24.7	Rel. Error (%) of 20 min. Sorp -41.3

TEMPERATURE STATISTICS

Column1	
Mean	30.00324974
Standard Error	0.000377758
Median	30.004
Mode	30.004
Standard Deviation	0.020381461
Sample Variance	0.000415404
Kurtosis	744.542963
Skewness	-21.7623114
Range	0.926
Minimum	29.253
Maximum	30.179
Sum	87339.46
Count	2911
Confidence Level(95.0%)	0.000740701

DIAMETER STATISTICS

	Column1	
	Mean	8.5075
	Standard Error	0.0225
	Median	8.495
	Mode	#N/A
	Standard Deviation	0.045
	Sample Variance	0.002025
	Kurtosis	0.97607072
	Skewness	1.24828532
	Range	0.1
	Minimum	8.47
	Maximum	8.57
ND/value	Sum	34.03
ND/value	Count	4
A/D	Confidence Level(95.0%)	0.07160511

THICKNESS STATISTICS

	Column1	
	Mean	37.85
	Standard Error	0.02886751
	Median	37.85
	Mode	37.8
	Standard Deviation	0.05773503
	Sample Variance	0.00333333
	Kurtosis	-6
Aflas	Skewness	3.6904E-13
tfep153z	Range	0.1
	Minimum	37.8
	Maximum	37.9
	Sum	151.4
	Count	4
	Confidence Level(95.0%)	0.0918694

HIGH CONCENTRATION DIFFUSION COEFFICIENT

tfep153z

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999987226
R Square	0.999974453
Adjusted R Square	0.999973572
Standard Error	0.000396
Observations	31

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.178008399	0.178008399	1135139.85	3.74453E-68
Residual	29	4.54767E-06	1.56816E-07		
Total	30	0.178012946			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.999351506	0.000304914	3277.48683	2.6367E-82	0.998727887	0.999975125
X Variable 1	-0.01112896	1.04455E-05	-1065.42942	3.7445E-68	-0.011150323	-0.011107596

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

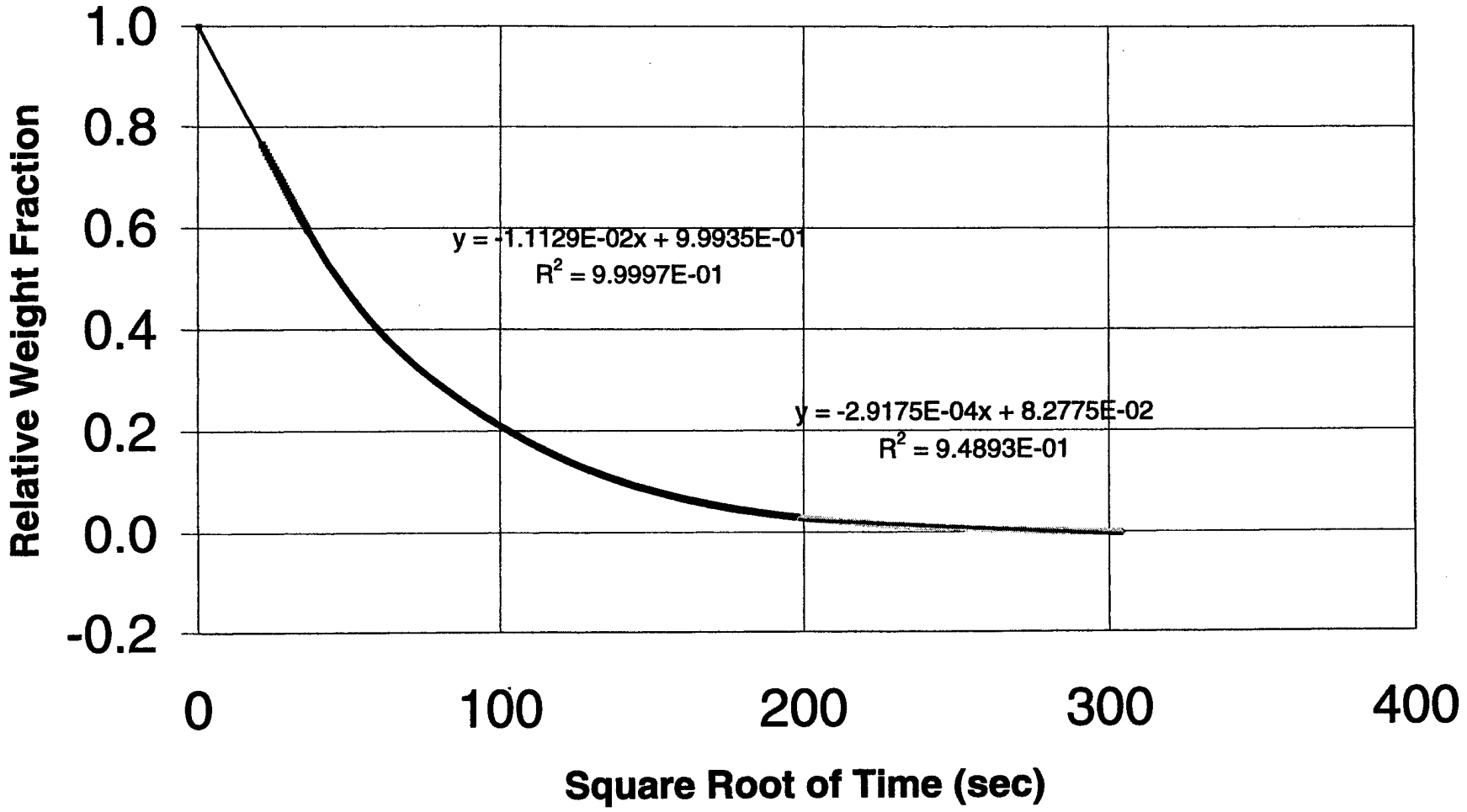
Regression Statistics	
Multiple R	0.974128452
R Square	0.948926241
Adjusted R Square	0.948894538
Standard Error	0.001909407
Observations	1613

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.109125722	0.109125722	29931.6165	0
Residual	1611	0.005873439	3.64583E-06		
Total	1612	0.114999162			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.082774917	0.000425528	194.5228466	0	0.08194027	0.083609564
X Variable 1	-0.000291753	1.68636E-06	-173.007562	0	-0.00029506	-0.000288445

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: TFEP (153z)



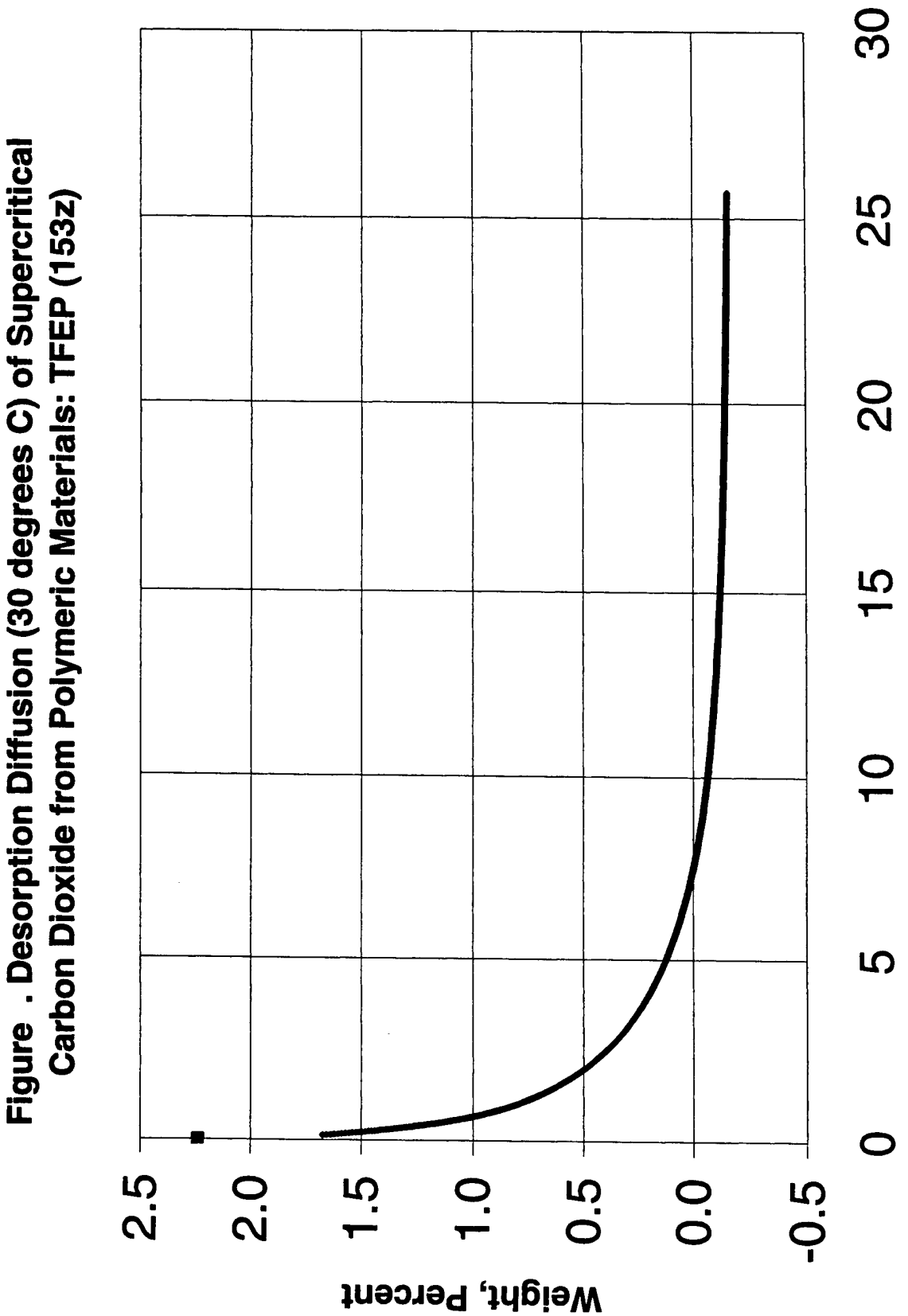


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: TFEP (153z)
Weight, Percent
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
0
5
10
15
20
25
30
Time, Hours

Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: TFEP (153z)

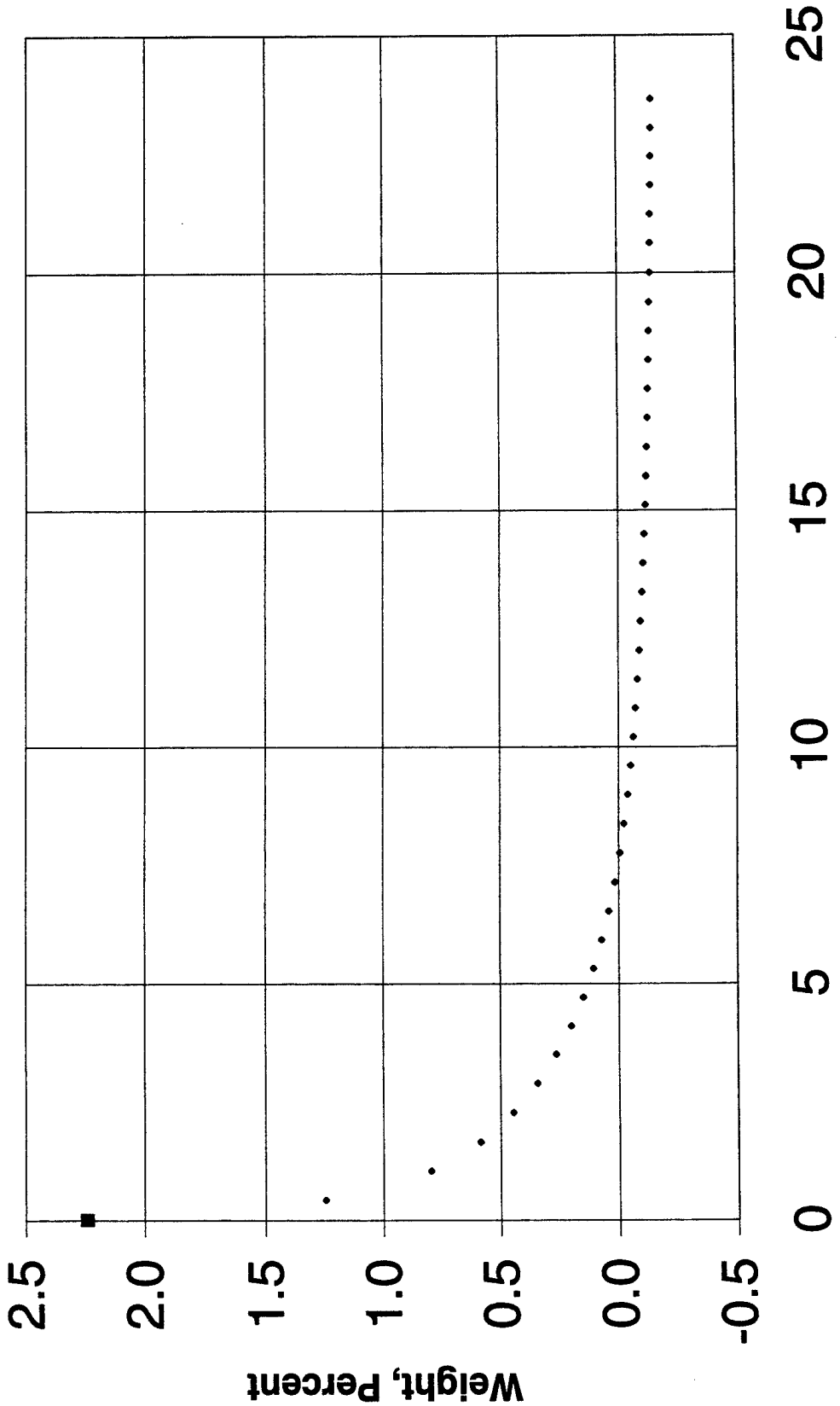
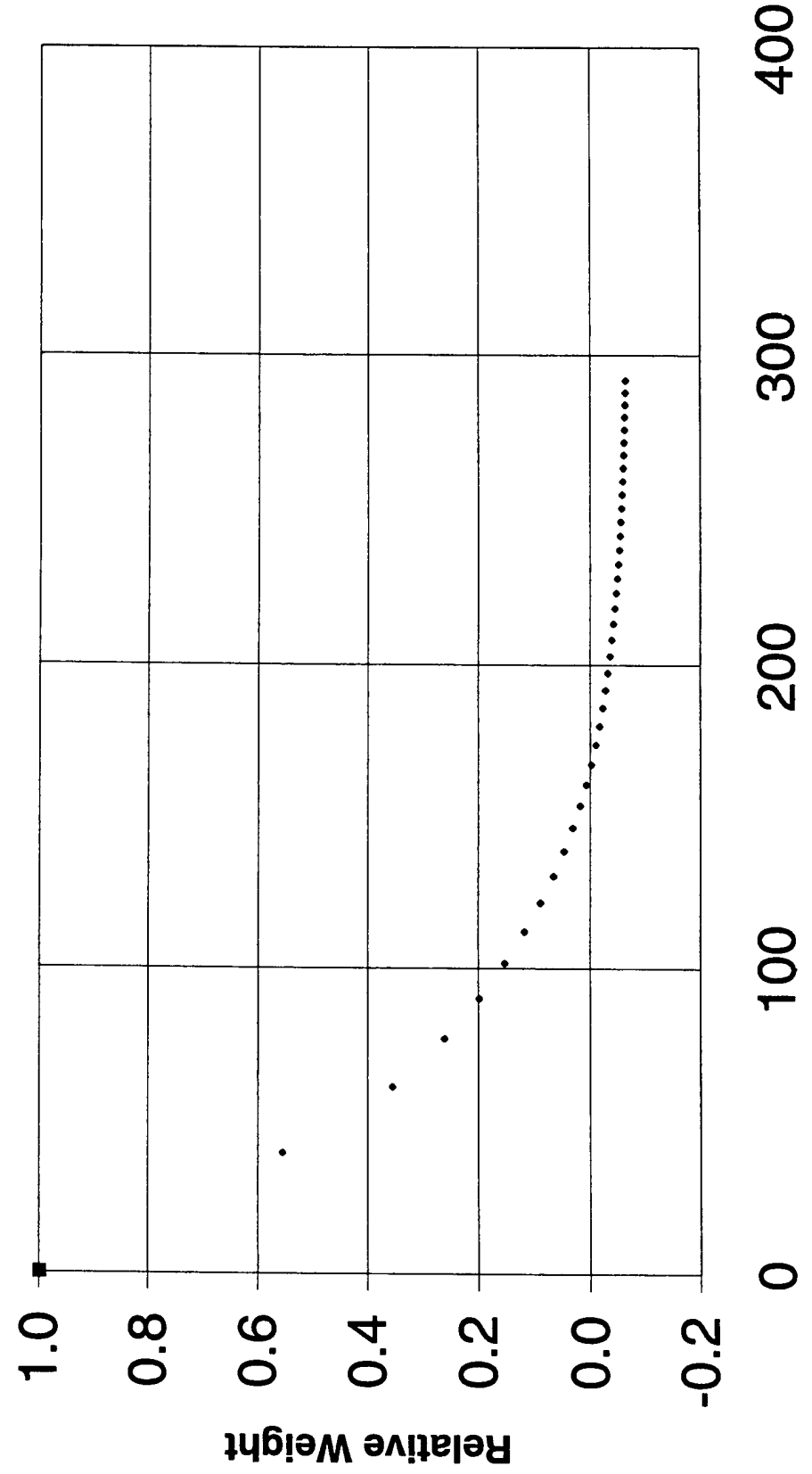


Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: TFEP (153z)



TGA Time, min	Temp., deg C	TGA Wt., mg	TGA Time, sec	Adjusted Time, sec	Adjusted Time, hr	SQRT Adj. Time, sec	Wt. Loss, %	Fractional Wt. Loss	Wt. @ Zero Time, mg	Wt. @ Zero Time, %	TGA Dry Wt., mg	Adjustment to TGA Time, sec	Hardness Scale
A	B	C	D	E	F	G	H	I	J	K	L	M	N
18.267	29.995	87.735	1096.020	1531.020	0.425	39.13	1.243	0.555	88.60	2.242	86.657	435	Shore A
54.949	30.004	87.347	3296.940	3731.940	1.037	61.09	0.796	0.355					
91.643	30.003	87.164	5498.580	5933.580	1.648	77.03	0.585	0.261					Pre Exposure
128.327	30.002	87.043	7699.620	8134.620	2.260	90.19	0.445	0.199	Formulae Used for Analysis of Data				Hardness
165.015	30.003	86.954	9900.900	10335.900	2.871	101.67	0.342	0.153	Uppercase letters refer to columns				91.7
201.762	30.002	86.885	12105.720	12540.720	3.484	111.99	0.263	0.117	Lowercase n refers to row, beginning with n=4				
238.467	30.001	86.830	14308.020	14743.020	4.095	121.42	0.200	0.089	----------				Post Desorption
275.211	30.001	86.785	16512.660	16947.660	4.708	130.18	0.148	0.066	Dn = (An * 60)				Hardness
311.908	30.002	86.749	18714.480	19149.480	5.319	138.38	0.106	0.047	En = (Dn + M4)				91.2
348.584	30.001	86.718	20915.040	21350.040	5.931	146.12	0.071	0.032	Fn = (En / 3600)				
385.271	30.001	86.693	23116.260	23551.260	6.542	153.46	0.041	0.018	Gn = SQRT (En)				Change in
421.962	30.004	86.671	25317.720	25752.720	7.154	160.48	0.017	0.007	Hn = (((Cn - L4) / L4) * 100)				Hardness, %
458.655	30.004	86.653	27519.300	27954.300	7.765	167.20	-0.005	-0.002	In = ((Cn - L4) / (J4 - L4))				-0.55
495.388	30.004	86.637	29723.280	30158.280	8.377	173.66	-0.023	-0.010	K4 = (((J4 - L4) / L4) * 100)				
532.135	30.004	86.624	31928.100	32363.100	8.990	179.90	-0.038	-0.017	N16 = (((N12 – N8) /N8) * 100)				
568.842	30.004	86.613	34130.520	34565.520	9.602	185.92	-0.051	-0.023					
605.566	30.003	86.603	36333.960	36768.960	10.214	191.75	-0.063	-0.028					
642.297	30.004	86.595	38537.820	38972.820	10.826	197.42	-0.072	-0.032	Source binary TA data file : tfep153z.01				
679.006	30.003	86.587	40740.360	41175.360	11.438	202.92	-0.081	-0.036	14 lines in the parameter block				
715.693	30.005	86.580	42941.580	43376.580	12.049	208.27	-0.088	-0.039	3 channels of data				
752.418	30.005	86.575	45145.080	45580.080	12.661	213.49	-0.095	-0.042	----------				
789.111	30.005	86.569	47346.660	47781.660	13.273	218.59	-0.101	-0.045	Run 47				
825.795	30.006	86.565	49547.700	49982.700	13.884	223.57	-0.107	-0.048	Module TGA Aluminum Pans				
862.505	30.006	86.561	51750.300	52185.300	14.496	228.44	-0.111	-0.050	Sample TFEP Poly(TFE/P) Aflas 0153Z				
899.183	30.006	86.557	53950.980	54385.980	15.107	233.21	-0.116	-0.052	Size 88.120 mg				
935.875	30.005	86.554	56152.500	56587.500	15.719	237.88	-0.119	-0.053	Method DESORPTION-Isothermal				
972.554	30.005	86.551	58353.240	58788.240	16.330	242.46	-0.123	-0.055	Operator bsi				
1009.234	30.005	86.548	60554.040	60989.040	16.941	246.96	-0.126	-0.056	Comment .34"x.040", HP15@1400 Dry: M-86.80 TGA-86.657 ET: 7:15				
1045.921	30.006	86.546	62755.260	63190.260	17.553	251.38	-0.129	-0.057	Nsig 3				
1082.634	30.006	86.543	64958.040	65393.040	18.165	255.72	-0.131	-0.059	Sig1 Time (min)				
1119.315	30.004	86.541	67158.900	67593.900	18.776	259.99	-0.134	-0.060	Sig2 Temperature (øC)				
1155.990	30.004	86.539	69359.400	69794.400	19.387	264.19	-0.136	-0.061	Sig3 Weight (mg)				
1192.685	30.004	86.538	71561.100	71996.100	19.999	268.32	-0.138	-0.062	Kcell 1.0000				
1229.411	30.004	86.536	73764.660	74199.660	20.611	272.40	-0.140	-0.062	Date 1-Jun-00				
1266.099	30.004	86.535	75965.940	76400.940	21.222	276.41	-0.141	-0.063	Time 11:14				
1302.805	30.002	86.533	78168.300	78603.300	21.834	280.36	-0.143	-0.064					
1339.546	30.003	86.532	80372.760	80807.760	22.447	284.27	-0.144	-0.064					
1376.260	30.001	86.531	82575.600	83010.600	23.059	288.12	-0.145	-0.065					
1412.963	30.001	86.530	84777.780	85212.780	23.670	291.91	-0.146	-0.065					

Blank

FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Polyetheretherketone PEEK

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	17-1-1	TGA Filename:	peek154z
Property Test Specification:	ASTM D471/D543		
Material Name:	Polyetheretherketone	Material Code:	PEEK
Material Supplier:	Goodfellow Cambridge Ltd.	Material Class:	Blank
Monomer Source:	Unknown	Base Polymer (Lot. No.):	Unknown
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	1

Pre-Exposure Data

Measured Diameter (mm):		8.52	8.39	8.51	8.49	
Mean Diameter:	8.500			95% Confidence Level (CL):		0.095
Measured Thickness (mils):		19.40	20.60	20.60	18.10	
Mean Thickness:	19.675			95% Confidence Level (CL):		1.898
Initial Sample Weight (mg):		31.620				
Initial Durometer Hardness:		76.4	Scale: SHORE		D	

Sample Exposure Data

Exposure Date:	06/02/00	Time:	13:16:00
Removal Date:	06/02/00	Time:	13:31:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	32.00
Weight Gain (mg):	0.38	Percent Weight Gain:	1.20
Final Durometer Hardness After Desorption:	77.0	Percent Hardness Change:	0.8

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.001	95% CL:	0.0008
Time Lapse Between Sample Exposure and Sample Desorption (sec):			460
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			31.530
Sample Extracted (mg): 0.09	Solubility Corrected for Extractables (mg):		0.47
Sample Extracted (%): 0.28	Solubility Corrected for Extractables (%):		1.49

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm2/sec):			7.9890E-08
Range Including 0,1 Intercept, Relative Weight Fraction:			1.00 - 0.65
Linear Range of Desorption, Relative Weight Fraction:			0.71 - 0.65
Slope:	-1.2764E-02	X-axis Intercept:	7.8057E+01
R Square:	0.99756	Y-axis Intercept:	9.9631E-01

Low Concentration Diffusion Coefficient (cm2/sec):			9.4139E-11
Linear Range of Desorption, Relative Weight Fraction:			0.05 - 0.00
Slope:	-4.3815E-04	X-axis Intercept:	3.7315E+02
R Square:	0.99517	Y-axis Intercept:	1.6349E-01

Wt. @ Zero Time, mg K 32.00	Wt. @ Zero Time, % L 1.202	Adjustment to TGA Time, sec M 460	Hardness Shore Scale N D
TGA Dry Wt., mg 31.620	Equil. Wt. Of Desorb. Sample 31.53	Min. Wt. Used For FDC, mg. 31.530	Pre Exposure Hardness 76.4
High Conc. DC, cm2/sec 7.9890E-08	Low Conc. DC, cm2/sec 9.4139E-11	Total Liquid Sorbed, mg. 0.380	Post Desorption Hardness 77.0
R Square 0.99756	R Square 0.99517		Change in Hardness, % 0.8
X Intercept 78.06	X Intercept 373.1		Mean Thickness, cm. 0.0500
Y Intercept 0.99631	Y Intercept 0.16349		**peek154z**
Y Intercept as Wt., mg. 31.882	X Intercept as Time, hrs. 38.7	X Intercept as Time, min. 232.1	X Intercept as Time, days 1.6
		Max. TGA Wt., (orig data file) 31.868	TGA Wt. At 20 min. Adjustment 31.809
		Sorption @ 7-12 min., mg 0.25	Sorption @ 20 min., mg 0.19
		Sorption @ 7-12 min., % 0.78	Sorption @ 20 min., % 0.60
		Rel. Error (%) of 7-12 min. Sorp. -34.7	Rel. Error (%) of 20 min. Sorp -50.3

TEMPERATURE STATISTICS

Column1	
Mean	30.00087581
Standard Error	0.000430896
Median	30.001
Mode	29.999
Standard Deviation	0.024576198
Sample Variance	0.000603989
Kurtosis	697.3108555
Skewness	-20.17012678
Range	1.14
Minimum	29.096
Maximum	30.236
Sum	97592.849
Count	3253
Confidence Level(95.0%)	0.000844855

DIAMETER STATISTICS

	Column1	
	Mean	8.4775
	Standard Error	0.02982588
	Median	8.5
	Mode	#N/A
	Standard Deviation	0.05965177
	Sample Variance	0.00355833
	Kurtosis	3.09087419
	Skewness	-1.749027
	Range	0.13
	Minimum	8.39
	Maximum	8.52
ND/value	Sum	33.91
ND/value	Count	4
A/D	Confidence Level(95.0%)	0.09491936

THICKNESS STATISTICS

	Column1	
	Mean	19.675
	Standard Error	0.59634302
	Median	20
	Mode	20.6
	Standard Deviation	1.19268604
	Sample Variance	1.4225
	Kurtosis	-0.941917
Unknown	Skewness	-0.9214039
peek154z	Range	2.5
	Minimum	18.1
	Maximum	20.6
	Sum	78.7
	Count	4
	Confidence Level(95.0%)	1.89783143

HIGH CONCENTRATION DIFFUSION COEFFICIENT

peek154z

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.998781593
R Square	0.997564671
Adjusted R Square	0.997321138
Standard Error	0.004906673
Observations	12

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.098618322	0.098618322	4096.22143	2.11023E-14
Residual	10	0.000240754	2.40754E-05		
Total	11	0.098859077			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.996311686	0.004754227	209.5633309	1.5049E-19	0.985718606	1.006904766
X Variable 1	-0.01276392	0.000199431	-64.00172992	2.1102E-14	-0.01320828	-0.012319561

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.997584511
R Square	0.995174856
Adjusted R Square	0.995170221
Standard Error	0.001161622
Observations	1043

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.28971378	0.28971378	214703.867	0
Residual	1041	0.001404688	1.34936E-06		
Total	1042	0.291118469			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.16349385	0.000287599	568.4775202	0	0.162929509	0.16405819
X Variable 1	-0.000438149	9.45589E-07	-463.3614866	0	-0.000440005	-0.000436294

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PEEK (154z)

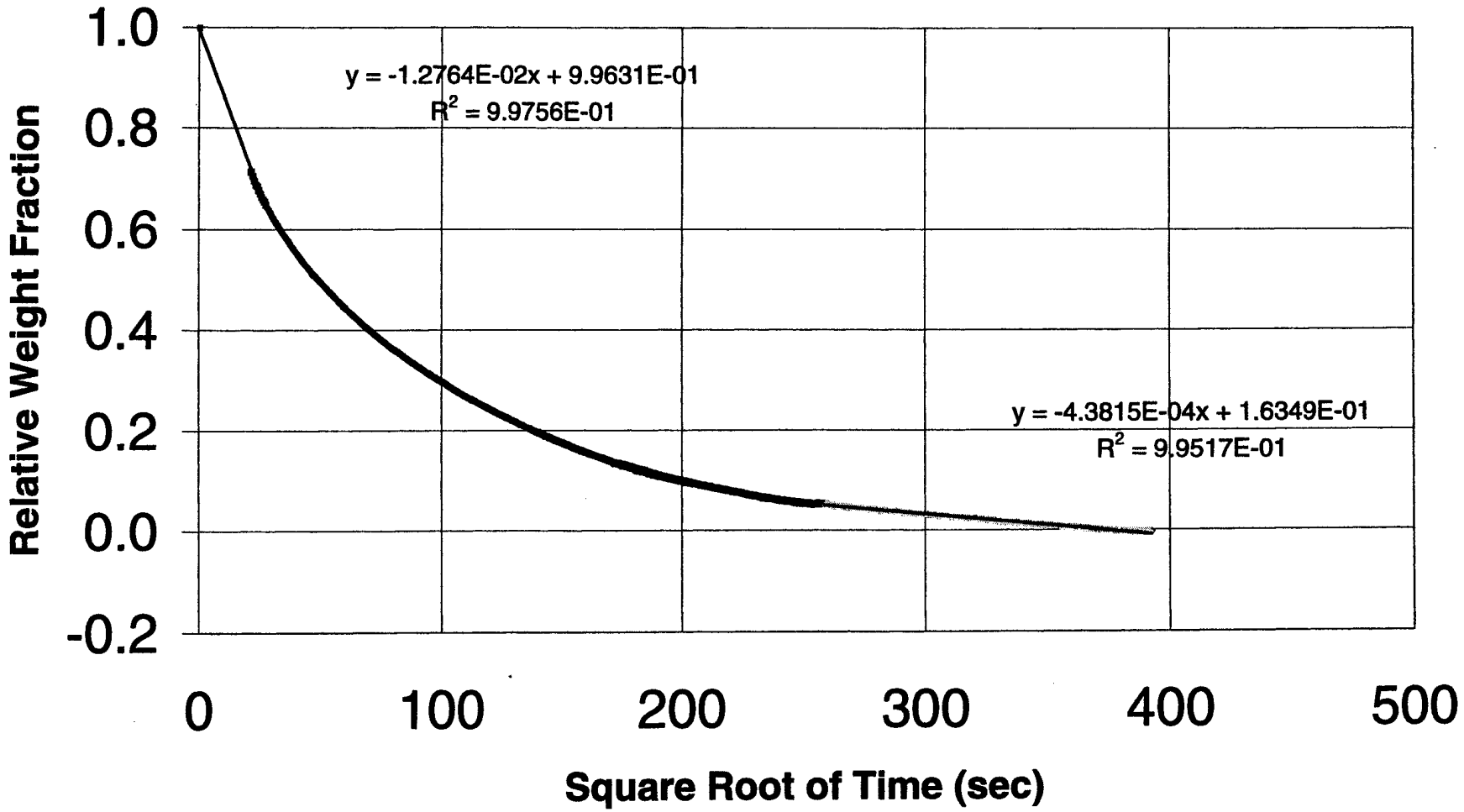


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PEEK (154z)

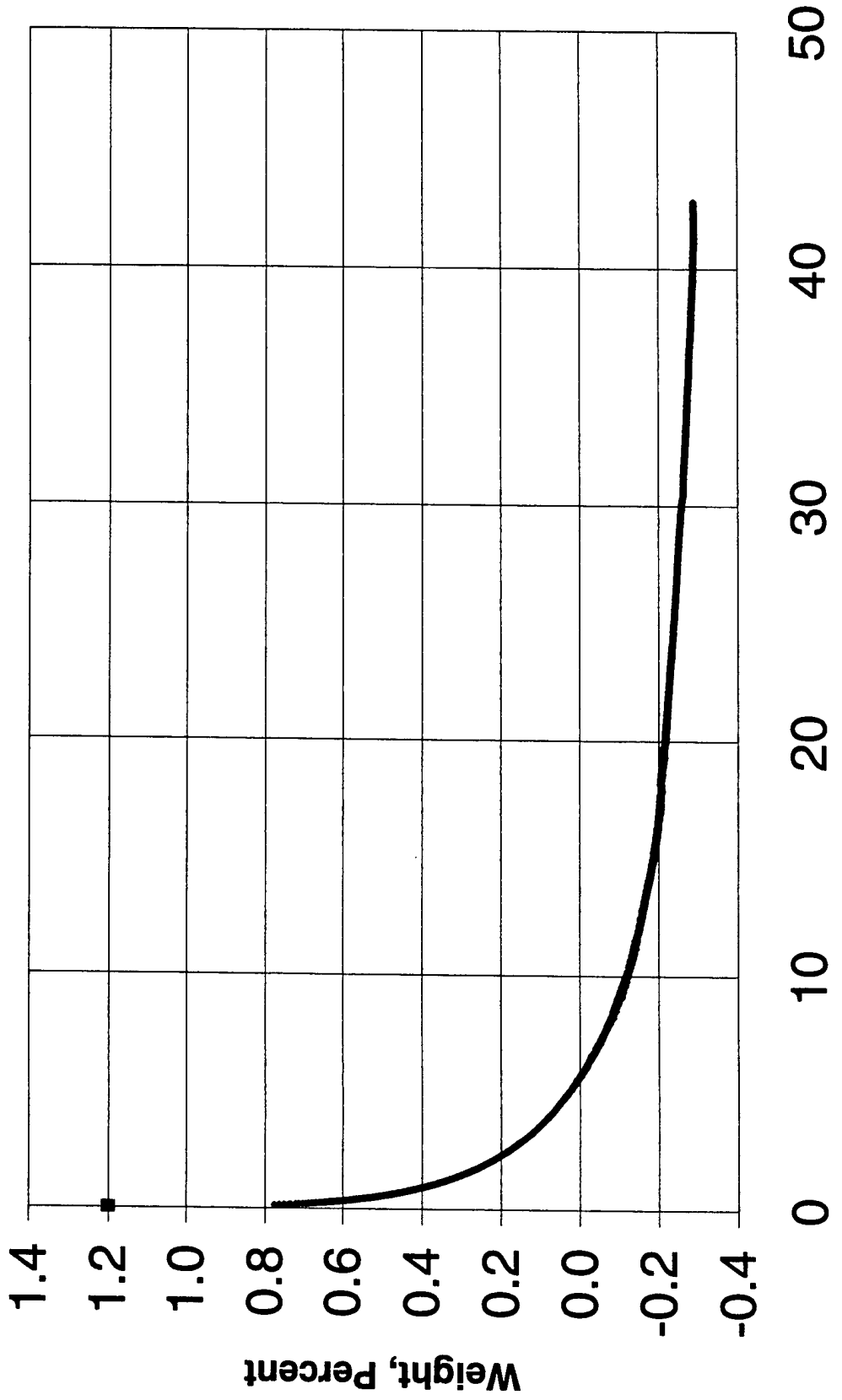


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PEEK (154z)

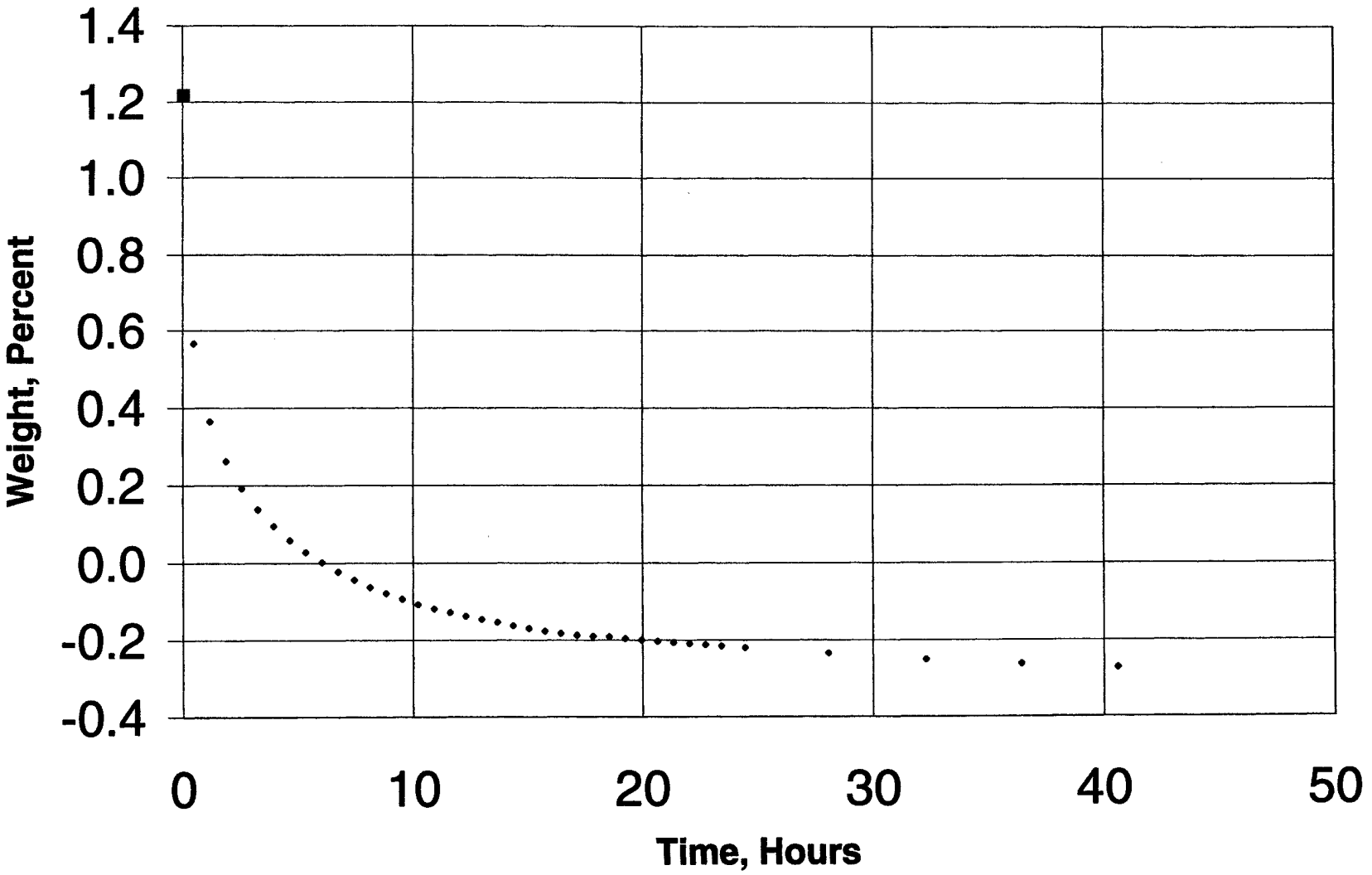
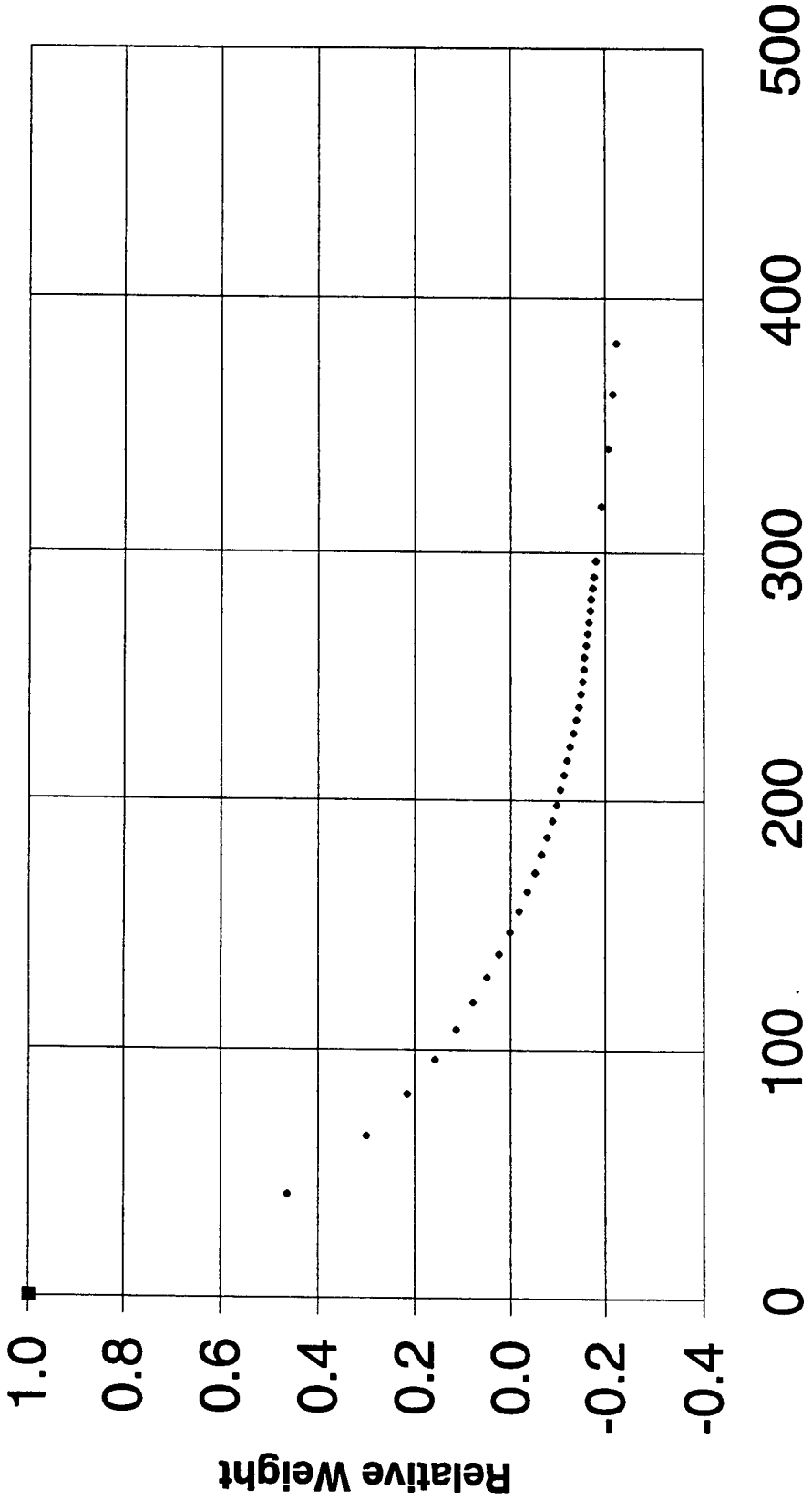


Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PEEK (154z)



TGA Time, min	Temp., deg C	TGA Wt., mg	TGA Time, sec	Adjusted Time, sec	Adjusted Time, hr	SQRT Adj. Time, sec	Wt. Loss, %	Fractional Wt. Loss	Wt. @ Zero Time, mg	Wt. @ Zero Time, %	TGA Dry Wt., mg	Adjustmentto TGA Time, sec	Hardness Scale
A	B	C	D	E	F	G	H	I	J	K	L	M	N
20.766	29.991	31.794	1245.960	1705.960	0.474	41.30	0.566	0.465	32.00	1.218	31.615	460	Shore D
62.465	30.000	31.730	3747.900	4207.900	1.169	64.87	0.365	0.300					
104.143	30.000	31.698	6248.580	6708.580	1.863	81.91	0.263	0.216					Pre Exposure
145.887	30.000	31.676	8753.220	9213.220	2.559	95.99	0.193	0.158	Formulae Used for Analysis of Data				Hardness
187.603	30.000	31.659	11256.180	11716.180	3.254	108.24	0.139	0.114	Uppercase letters refer to columns				76.4
229.349	30.001	31.645	13760.940	14220.940	3.950	119.25	0.096	0.079	Lowercase n refers to row, beginning with n=4				
271.066	30.000	31.634	16263.960	16723.960	4.646	129.32	0.060	0.049	----------				Post Desorption
312.757	30.001	31.624	18765.420	19225.420	5.340	138.66	0.029	0.024	Dn = (An * 60)				Hardness
354.506	30.001	31.616	21270.360	21730.360	6.036	147.41	0.002	0.002	En = (Dn + M4)				77.0
396.227	30.000	31.608	23773.620	24233.620	6.732	155.67	-0.022	-0.018	Fn = (En / 3600)				
437.952	30.001	31.601	26277.120	26737.120	7.427	163.51	-0.043	-0.036	Gn = SQRT (En)				Change in
479.678	30.001	31.595	28780.680	29240.680	8.122	171.00	-0.063	-0.052	Hn = (((Cn - L4) / L4) * 100)				Hardness, %
521.376	30.000	31.590	31282.560	31742.560	8.817	178.16	-0.079	-0.065	In = ((Cn - L4) / (J4 - L4))				0.79
563.065	30.001	31.585	33783.900	34243.900	9.512	185.05	-0.094	-0.077	K4 = (((J4 - L4) / L4) * 100)				
604.761	30.001	31.581	36285.660	36745.660	10.207	191.69	-0.108	-0.088	N16 = (((N12 – N8) /N8) * 100)				
646.458	30.002	31.578	38787.480	39247.480	10.902	198.11	-0.119	-0.097					
688.136	30.000	31.575	41288.160	41748.160	11.597	204.32	-0.128	-0.105					
729.818	30.001	31.571	43789.080	44249.080	12.291	210.35	-0.138	-0.113	Source binary TA data file : peek154z.01				
771.536	30.002	31.569	46292.160	46752.160	12.987	216.22	-0.146	-0.120	14 lines in the parameter block				
813.236	30.003	31.566	48794.160	49254.160	13.682	221.93	-0.154	-0.126	3 channels of data				
854.920	30.002	31.564	51295.200	51755.200	14.376	227.50	-0.163	-0.134	----------				
896.635	30.001	31.561	53798.100	54258.100	15.072	232.93	-0.170	-0.140	Run 48				
938.362	30.002	31.559	56301.720	56761.720	15.767	238.25	-0.177	-0.145	Module TGA Aluminum Pans				
980.082	30.001	31.557	58804.920	59264.920	16.462	243.44	-0.182	-0.150	Sample PEEK SCO2 0154Z				
1021.799	30.002	31.556	61307.940	61767.940	17.158	248.53	-0.187	-0.154	Size 31.868 mg				
1063.517	30.002	31.555	63811.020	64271.020	17.853	253.52	-0.190	-0.156	Method DESORPTION-Isothermal				
1105.202	30.002	31.555	66312.120	66772.120	18.548	258.40	-0.191	-0.157	Operator bsi				
1146.919	30.002	31.553	68815.140	69275.140	19.243	263.20	-0.196	-0.161	Comment .334"x.020", HP15@1400 Dry: M-31.62 TGA-31.615 ET: 7:40				
1188.665	30.002	31.552	71319.900	71779.900	19.939	267.92	-0.200	-0.164	Nsig 3				
1230.382	30.000	31.551	73822.920	74282.920	20.634	272.55	-0.203	-0.167	Sig1 Time (min)				
1272.100	30.001	31.550	76326.000	76786.000	21.329	277.10	-0.206	-0.169	Sig2 Temperature (øC)				
1313.792	30.001	31.549	78827.520	79287.520	22.024	281.58	-0.209	-0.172	Sig3 Weight (mg)				
1355.506	30.000	31.548	81330.360	81790.360	22.720	285.99	-0.212	-0.174	Kcell 1.0000				
1397.207	30.002	31.547	83832.420	84292.420	23.415	290.33	-0.215	-0.177	Date 2-Jun-00				
1459.442	30.001	31.546	87566.520	88026.520	24.452	296.69	-0.220	-0.181	Time 13:39				
1677.259	30.001	31.541	100635.540	101095.540	28.082	317.96	-0.234	-0.192					
1927.273	30.002	31.536	115636.380	116096.380	32.249	340.73	-0.251	-0.206					
2177.282	30.001	31.532	130636.920	131096.920	36.416	362.07	-0.262	-0.215					
2427.304	30.002	31.529	145638.240	146098.240	40.583	382.23	-0.272	-0.223					

Blank

FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Polydimethylsiloxane PDMS

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	12-1-2	TGA Filename:	pdms139d
Property Test Specification:	ASTM D471/D543		
Material Name:	Polydimethylsiloxane	Material Code:	PDMS
Material Supplier:	Smithers Scientific	Material Class:	MQ
Monomer Source:	Mine Safety, GE	Base Polymer (Lot. No.):	Silicone 306017B
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	2

Pre-Exposure Data

Measured Diameter (mm):	8.50	8.53	8.46	8.53	
Mean Diameter:	8.515		95% Confidence Level (CL):		0.053
Measured Thickness (mils):	46.40	46.60	46.90	47.90	
Mean Thickness:	46.950		95% Confidence Level (CL):		1.059
Initial Sample Weight (mg):	77.560				
Initial Durometer Hardness:	63.9	Scale: SHORE	A		

Sample Exposure Data

Exposure Date:	05/18/00	Time:	13:45:00
Removal Date:	05/18/00	Time:	14:00:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	77.90
Weight Gain (mg):	0.34	Percent Weight Gain:	0.44
Final Durometer Hardness After Desorption:	64.9	Percent Hardness Change:	1.6

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	29.999	95% CL:	0.0016
Time Lapse Between Sample Exposure and Sample Desorption (sec):			495
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			77.580
Sample Extracted (mg):	-0.02	Solubility Corrected for Extractables (mg):	0.34
Sample Extracted (%):	-0.03	Solubility Corrected for Extractables (%):	0.44

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm2/sec):			2.9977E-06
Range Including 0,1 Intercept, Relative Weight Fraction:			1.00 - 0.20
Linear Range of Desorption, Relative Weight Fraction:			0.27 - 0.20
Slope:	-3.2765E-02	X-axis Intercept:	3.0531E+01
R Square:	0.99985	Y-axis Intercept:	1.0004E+00

Low Concentration Diffusion Coefficient (cm2/sec):			1.1404E-10
Linear Range of Desorption, Relative Weight Fraction:			0.10 - 0.07
Slope:	-2.0209E-04	X-axis Intercept:	5.4657E+02
R Square:	0.95730	Y-axis Intercept:	1.1046E-01

Wt. @ Zero Time, mg K 77.90	Wt. @ Zero Time, % L 0.438	Adjustment to TGA Time, sec M 495	Hardness Shore Scale N A
TGA Dry Wt., mg 77.560	Equil. Wt. Of Desorb. Sample 77.58	Min. Wt. Used For FDC, mg. 77.560	Pre Exposure Hardness 63.9
High Conc. DC, cm2/sec 2.9977E-06	Low Conc. DC, cm2/sec 1.1404E-10	Total Liquid Sorbed, mg. 0.340	Post Desorption Hardness 64.9
R Square 0.99985	R Square 0.95730		Change in Hardness, % 1.6
X Intercept 30.53	X Intercept 546.6		Mean Thickness, cm. 0.1193
Y Intercept 1.00036	Y Intercept 0.11046		
Y Intercept as Wt., mg. 77.928	X Intercept as Time, hrs. 83.0	X Intercept as Time, min. 497.9	**pdms139d** X Intercept as Time, days 3.5
		Max. TGA Wt., (orig data file) 77.661	TGA Wt. At 20 min. Adjustment 77.605
		Sorption @ 7-12 min., mg 0.10	Sorption @ 20 min., mg 0.05
		Sorption @ 7-12 min., % 0.13	Sorption @ 20 min., % 0.06
		Rel. Error (%) of 7-12 min. Sorp. -70.3	Rel. Error (%) of 20 min. Sorp -86.8

TEMPERATURE STATISTICS

Column1	
Mean	29.99932403
Standard Error	0.000810539
Median	30
Mode	30.001
Standard Deviation	0.030305911
Sample Variance	0.000918448
Kurtosis	473.3664074
Skewness	-19.01879488
Range	0.988
Minimum	29.164
Maximum	30.152
Sum	41939.055
Count	1398
Confidence Level(95.0%)	0.001590003

DIAMETER STATISTICS

	Column1	
	Mean	8.505
	Standard Error	0.01658312
	Median	8.515
	Mode	8.53
	Standard Deviation	0.03316625
	Sample Variance	0.0011
	Kurtosis	-0.0495868
	Skewness	-1.0964049
	Range	0.07
	Minimum	8.46
	Maximum	8.53
ND/value	Sum	34.02
ND/value	Count	4
A/D	Confidence Level(95.0%)	0.05277495

THICKNESS STATISTICS

	Column1	
	Mean	46.95
	Standard Error	0.33291641
	Median	46.75
	Mode	#N/A
	Standard Deviation	0.66583281
	Sample Variance	0.44333333
	Kurtosis	2.12030075
Silicone 306017B	Skewness	1.46348464
pdms139d	Range	1.5
	Minimum	46.4
	Maximum	47.9
	Sum	187.8
	Count	4
	Confidence Level(95.0%)	1.05948958

HIGH CONCENTRATION DIFFUSION COEFFICIENT

pdms139d

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999922767
R Square	0.99984554
Adjusted R Square	0.999794054
Standard Error	0.004940927
Observations	5

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.474084097	0.474084097	19419.5215	8.14765E-07
Residual	3	7.32383E-05	2.44128E-05		
Total	4	0.474157336			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	1.000357561	0.004931748	202.840359	2.6422E-07	0.984662523	1.016052599
X Variable 1	-0.032764957	0.00023512	-139.3539432	8.1477E-07	-0.033513216	-0.032016698

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

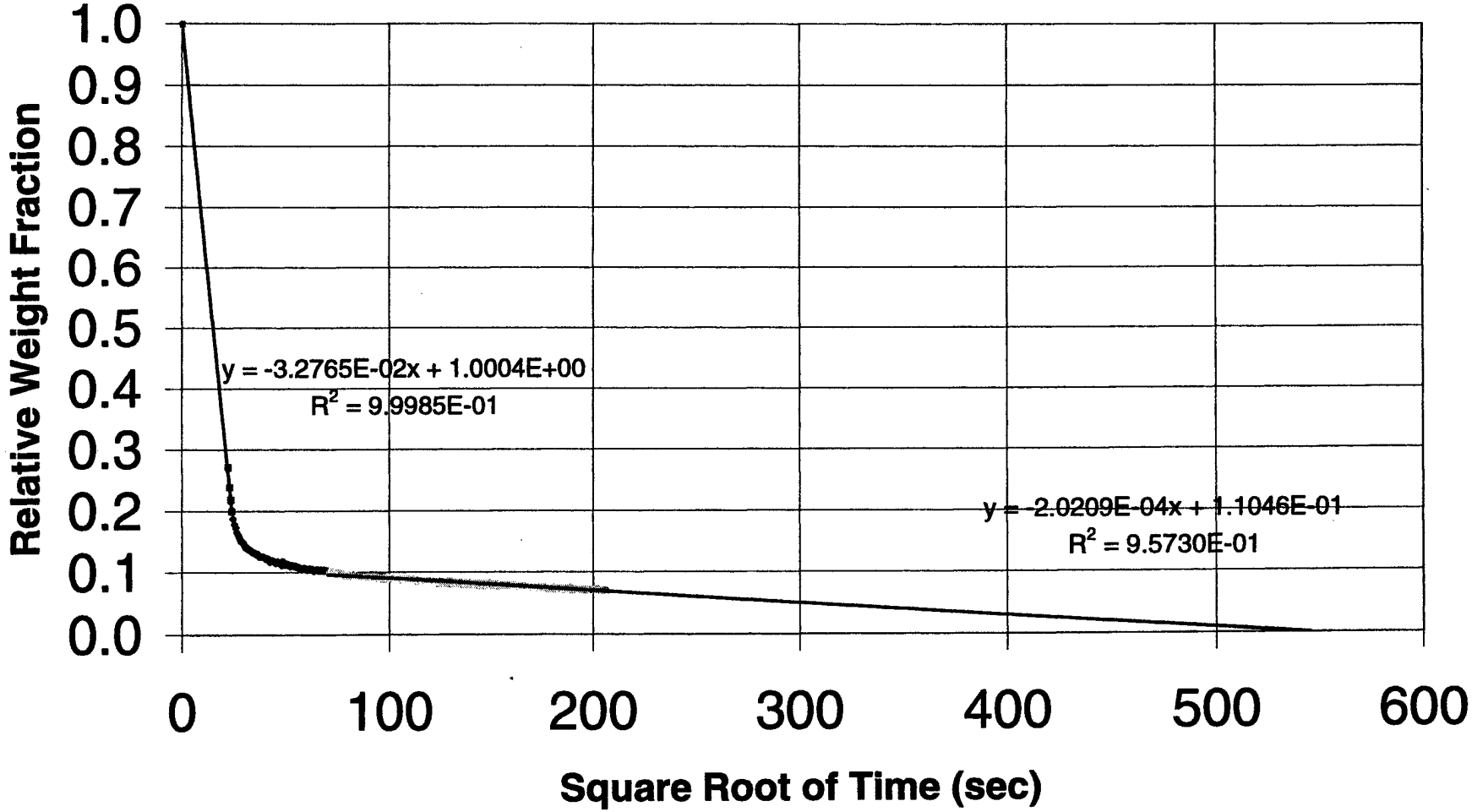
Regression Statistics	
Multiple R	0.978415444
R Square	0.957296781
Adjusted R Square	0.957262591
Standard Error	0.001608951
Observations	1251

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.072482686	0.072482686	27999.3805	0
Residual	1249	0.003233317	2.58872E-06		
Total	1250	0.075716003			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.110456779	0.000185908	594.1465439	0	0.110092052	0.110821507
X Variable 1	-0.000202092	1.20774E-06	-167.3301541	0	-0.000204461	-0.000199722

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PDMS (139d)



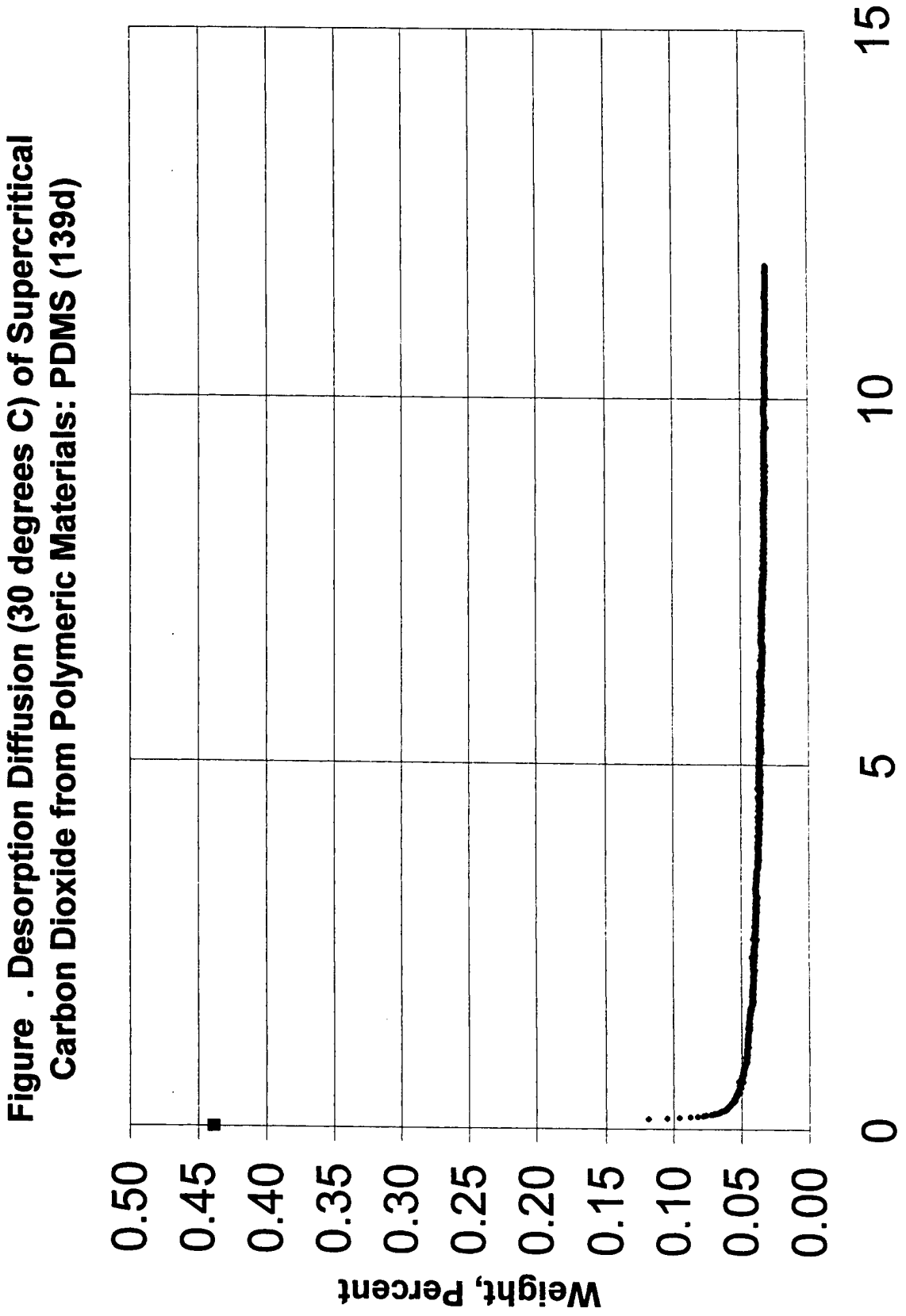


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PDMS (139d)
Weight, Percent
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0
5
10
15
Time, Hours

Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PDMS (139d)

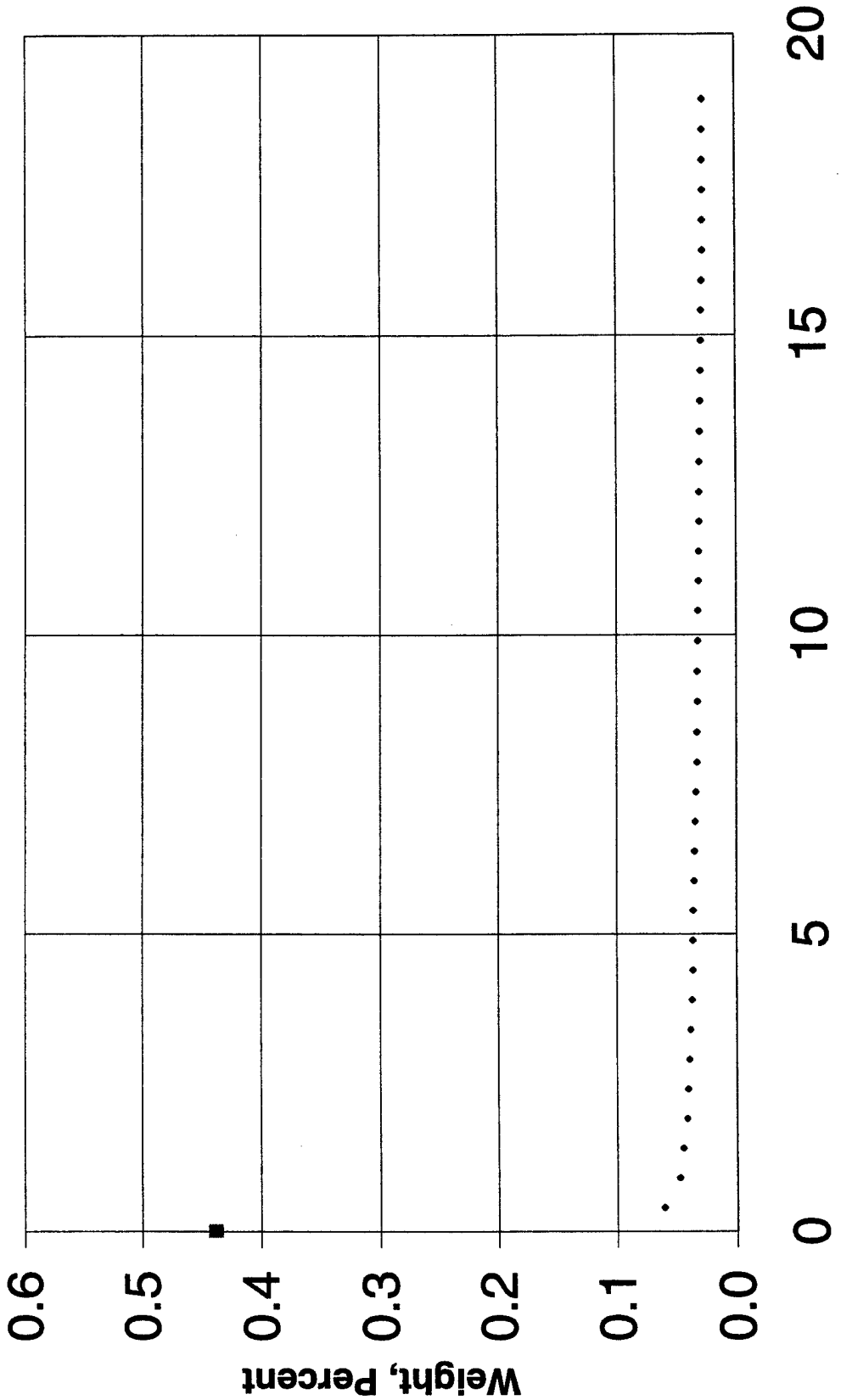
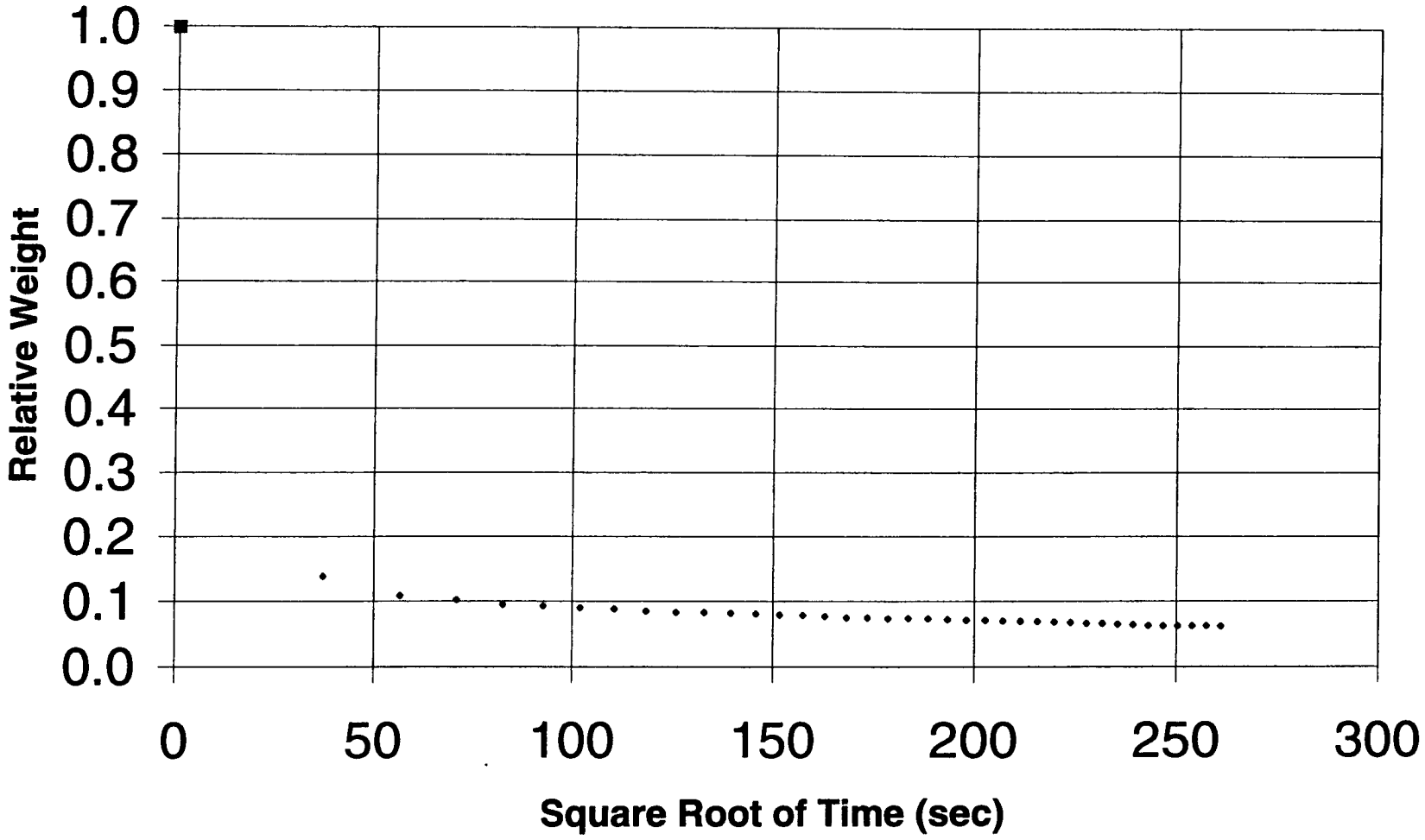


Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PDMS (139d)



TGA Time, min A	Temp., deg C B	TGA Wt., mg C	TGA Time, sec D	Adjusted Time, sec E	Adjusted Time, hr F	SQRT Adj. Time, sec G	Wt. Loss, % H	Fractional Wt. Loss I	Wt. @ Zero Time, mg J	Wt. @ Zero Time, % K	TGA Dry Wt., mg L	Adjustment to TGA Time, sec M	Hardness Scale N
14.919	29.979	77.607	895.140	1390.140	0.386	37.28	0.061	0.138	77.90	0.438	77.56	495	Shore A
44.935	30.000	77.597	2696.100	3191.100	0.886	56.49	0.048	0.109					
74.985	30.000	77.595	4499.100	4994.100	1.387	70.67	0.045	0.102					
105.009	30.001	77.592	6300.540	6795.540	1.888	82.44	0.042	0.095					
135.030	30.000	77.592	8101.800	8596.800	2.388	92.72	0.041	0.093					
165.083	30.000	77.591	9904.980	10399.980	2.889	101.98	0.039	0.090					
195.115	30.000	77.590	11706.900	12201.900	3.389	110.46	0.039	0.088					
225.215	30.000	77.589	13512.900	14007.900	3.891	118.35	0.037	0.085					
255.230	30.000	77.588	15313.800	15808.800	4.391	125.73	0.036	0.083					
285.285	30.001	77.588	17117.100	17612.100	4.892	132.71	0.036	0.083					
315.345	30.000	77.588	18920.700	19415.700	5.393	139.34	0.036	0.082					
345.368	30.000	77.587	20722.080	21217.080	5.894	145.66	0.035	0.081					
375.386	30.001	77.587	22523.160	23018.160	6.394	151.72	0.035	0.079					
405.397	30.000	77.587	24323.820	24818.820	6.894	157.54	0.034	0.079					
435.418	30.000	77.586	26125.080	26620.080	7.394	163.16	0.034	0.077					
465.456	30.000	77.585	27927.360	28422.360	7.895	168.59	0.033	0.075					
495.551	30.001	77.585	29733.060	30228.060	8.397	173.86	0.033	0.075					
525.647	30.000	77.585	31538.820	32033.820	8.898	178.98	0.032	0.074					
555.692	30.000	77.585	33341.520	33836.520	9.399	183.95	0.032	0.074					
585.714	30.001	77.585	35142.840	35637.840	9.899	188.78	0.032	0.073					
615.769	30.000	77.585	36946.140	37441.140	10.400	193.50	0.032	0.072					
645.776	30.001	77.584	38746.560	39241.560	10.900	198.09	0.031	0.071					
675.803	30.000	77.584	40548.180	41043.180	11.401	202.59	0.031	0.071					
705.829	30.000	77.584	42349.740	42844.740	11.901	206.99	0.031	0.070					
735.854	30.000	77.584	44151.240	44646.240	12.402	211.30	0.031	0.070					
765.944	30.000	77.584	45956.640	46451.640	12.903	215.53	0.030	0.069					
795.979	30.001	77.583	47758.740	48253.740	13.404	219.67	0.030	0.068					
826.024	30.000	77.583	49561.440	50056.440	13.905	223.73	0.030	0.067					
856.048	30.001	77.583	51362.880	51857.880	14.405	227.72	0.029	0.066					
886.072	30.000	77.582	53164.320	53659.320	14.905	231.64	0.029	0.066					
916.091	30.000	77.582	54965.460	55460.460	15.406	235.50	0.028	0.065					
946.139	30.000	77.582	56768.340	57263.340	15.906	239.30	0.028	0.064					
976.202	30.000	77.581	58572.120	59067.120	16.408	243.04	0.027	0.063					
1006.219	30.000	77.581	60373.140	60868.140	16.908	246.71	0.027	0.062					
1036.236	30.000	77.581	62174.160	62669.160	17.408	250.34	0.027	0.062					
1066.270	30.000	77.581	63976.200	64471.200	17.909	253.91	0.027	0.062					
1096.330	30.000	77.581	65779.800	66274.800	18.410	257.44	0.027	0.062					
1126.394	30.000	77.581	67583.640	68078.640	18.911	260.92	0.027	0.062					

Pre Exposure Hardness
63.9

Post Desorption Hardness
64.9

Change in Hardness, %
1.56

Formulae Used for Analysis of Data
Uppercase letters refer to columns
Lowercase n refers to row, beginning with n=4

Dn = (An * 60)
En = (Dn + M4)
Fn = (En / 3600)
Gn = SQRT (En)
Hn = (((Cn - L4) / L4) * 100)
In = ((Cn - L4) / (J4 - L4))
K4 = (((J4 - L4) / L4) * 100)
N16 = (((N12 – N8) /N8) * 100)

Source binary TA data file : pdms139d.01
14 lines in the parameter block
3 channels of data

Run 42
Module TGA Aluminum Pans
Sample PDMS Glove SC02 139d Disk
Size 77.661 mg
Method DESORPTION-Isothermal
Operator ws
Comment .335"x.047",HP@1400x50,Dry:DS-77.5 M-77.50 TG-77.560 ET: 8:15
Nsig 3
Sig1 Time (min)
Sig2 Temperature (øC)
Sig3 Weight (mg)
Kcell 1.0000
Date 18-May-00
Time 14:09

Blank

FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Polybromobutylene-isoprene PBB

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	10-1-1	TGA Filename:	pbb0138d
Property Test Specification:	ASTM D471/D543		
Material Name:	Polybromobutylene-isoprene	Material Code:	PBB
Material Supplier:	Smithers Scientific	Material Class:	BIIR
Monomer Source:	Miles/Dupont	Base Polymer (Lot. No.):	Unknown
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	1

Pre-Exposure Data

Measured Diameter (mm):	8.50	8.6	8.51	8.52	
Mean Diameter:	8.515		95% Confidence Level (CL):		0.073
Measured Thickness (mils):	41.40	41.60	41.60	41.40	
Mean Thickness:	41.500		95% Confidence Level (CL):		0.184
Initial Sample Weight (mg):	68.350				
Initial Durometer Hardness:	65.9	Scale: SHORE	A		

Sample Exposure Data

Exposure Date:	05/17/00	Time:	10:06:00
Removal Date:	05/17/00	Time:	10:21:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	70.40
Weight Gain (mg):	2.05	Percent Weight Gain:	3.00
Final Durometer Hardness After Desorption:	67.8	Percent Hardness Change:	2.9

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.000	95% CL:	0.0011
Time Lapse Between Sample Exposure and Sample Desorption (sec):			685
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			68.270
Sample Extracted (mg):	0.08	Solubility Corrected for Extractables (mg):	2.13
Sample Extracted (%):	0.12	Solubility Corrected for Extractables (%):	3.12

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm2/sec):			8.4153E-07
Range Including 0,1 Intercept, Relative Weight Fraction:			1.00 - 0.35
Linear Range of Desorption, Relative Weight Fraction:			0.49 - 0.35
Slope:	-1.9640E-02	X-axis Intercept:	5.0890E+01
R Square:	0.99983	Y-axis Intercept:	9.9947E-01

Low Concentration Diffusion Coefficient (cm2/sec):			7.9684E-11
Linear Range of Desorption, Relative Weight Fraction:			0.04 - 0.00
Slope:	-1.9111E-04	X-axis Intercept:	2.9056E+02
R Square:	0.98726	Y-axis Intercept:	5.5529E-02

Wt. @ Zero Time, mg K 70.40	Wt. @ Zero Time, % L 2.999	Adjustment to TGA Time, sec M 685	Hardness Shore Scale N A
TGA Dry Wt., mg 68.350	Equil. Wt. Of Desorb. Sample 68.27	Min. Wt. Used For FDC, mg. 68.270	Pre Exposure Hardness 65.9
High Conc. DC, cm2/sec 8.4153E-07	Low Conc. DC, cm2/sec 7.9684E-11	Total Liquid Sorbed, mg. 2.050	Post Desorption Hardness 67.8
R Square 0.99983	R Square 0.98726		Change in Hardness, % 2.9
X Intercept 50.89	X Intercept 290.6		Mean Thickness, cm. 0.1054
Y Intercept 0.99947	Y Intercept 0.05553		
Y Intercept as Wt., mg. 70.363	X Intercept as Time, hrs. 23.5	X Intercept as Time, min. 140.7	**pbb0138d** X Intercept as Time, days 1.0
		Max. TGA Wt., (orig data file) 69.317	TGA Wt. At 20 min. Adjustment 68.966
		Sorption @ 7-12 min., mg 0.97	Sorption @ 20 min., mg 0.62
		Sorption @ 7-12 min., % 1.41	Sorption @ 20 min., % 0.90
		Rel. Error (%) of 7-12 min. Sorp. -52.8	Rel. Error (%) of 20 min. Sorp -70.0

TEMPERATURE STATISTICS

Column1	
Mean	30.0001569
Standard Error	0.000576801
Median	30
Mode	30
Standard Deviation	0.030787355
Sample Variance	0.000947861
Kurtosis	450.4323926
Skewness	-14.59614998
Range	1.259
Minimum	29.054
Maximum	30.313
Sum	85470.447
Count	2849
Confidence Level(95.0%)	0.001130991

DIAMETER STATISTICS

	Column1	
	Mean	8.5325
	Standard Error	0.02286737
	Median	8.515
	Mode	#N/A
	Standard Deviation	0.04573474
	Sample Variance	0.00209167
	Kurtosis	3.3803273
	Skewness	1.81106705
	Range	0.1
	Minimum	8.5
	Maximum	8.6
ND/value	Sum	34.13
ND/value	Count	4
A/D	Confidence Level(95.0%)	0.07277425

THICKNESS STATISTICS

	Column1	
	Mean	41.5
	Standard Error	0.05773503
	Median	41.5
	Mode	41.4
	Standard Deviation	0.11547005
	Sample Variance	0.01333333
	Kurtosis	-6
Unknown	Skewness	0
pbb0138d	Range	0.2
	Minimum	41.4
	Maximum	41.6
	Sum	166
	Count	4
	Confidence Level(95.0%)	0.1837388

HIGH CONCENTRATION DIFFUSION COEFFICIENT

pbb0138d

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.99991495
R Square	0.999829908
Adjusted R Square	0.999817759
Standard Error	0.002070178
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.352684355	0.352684355	82294.5048	8.62865E-28
Residual	14	5.99989E-05	4.28564E-06		
Total	15	0.352744354			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.999472153	0.001994127	501.2079449	3.4963E-31	0.995195172	1.003749133
X Variable 1	-0.019639835	6.84624E-05	-286.8701881	8.6287E-28	-0.019786673	-0.019492998

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

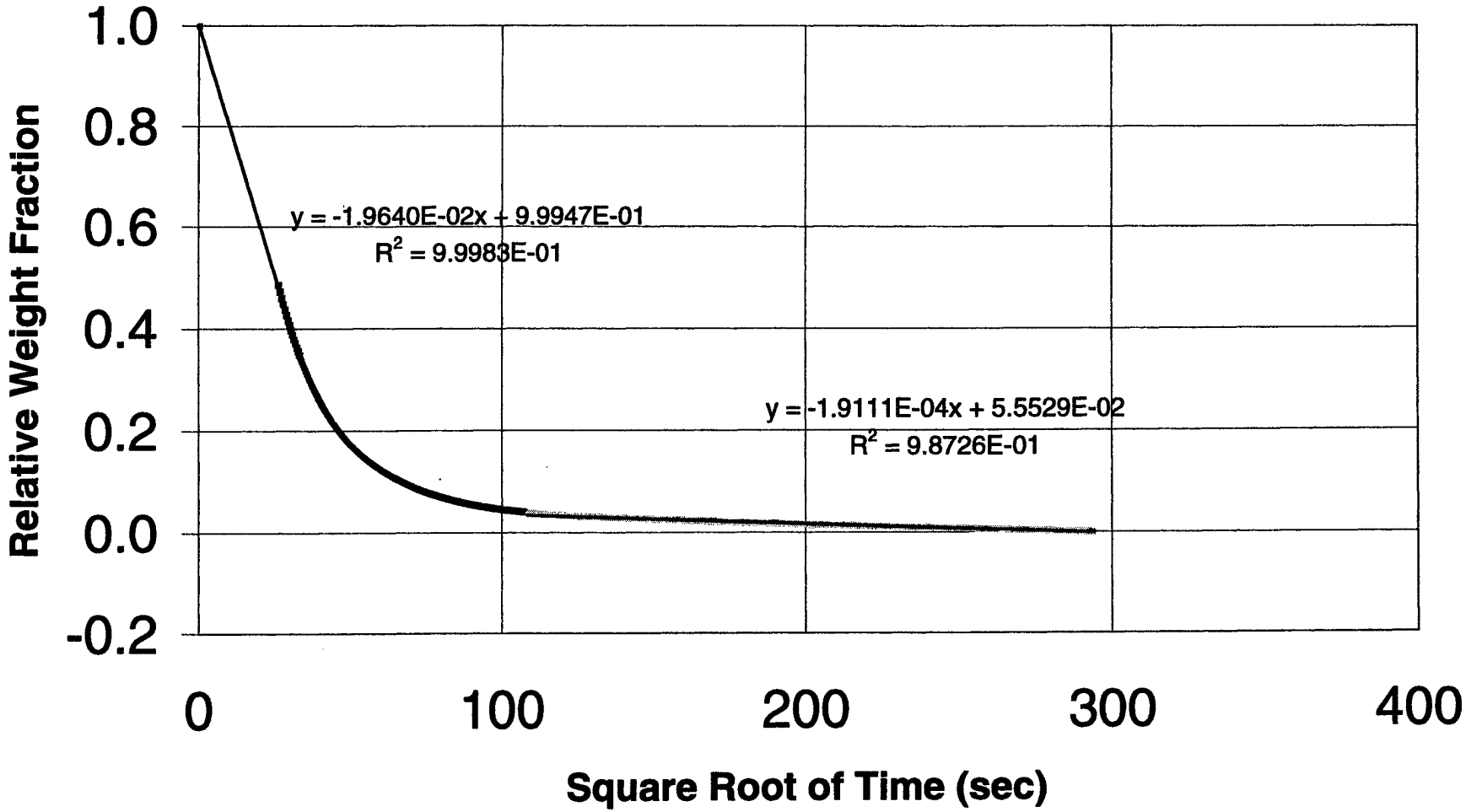
Regression Statistics	
Multiple R	0.993609146
R Square	0.987259134
Adjusted R Square	0.987253995
Standard Error	0.001120332
Observations	2481

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.241102733	0.241102733	192091.765	0
Residual	2479	0.003111501	1.25514E-06		
Total	2480	0.244214234			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.055529087	9.65065E-05	575.3920966	0	0.055339846	0.055718329
X Variable 1	-0.000191113	4.36049E-07	-438.2827455	0	-0.000191968	-0.000190258

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PBB (0138d)



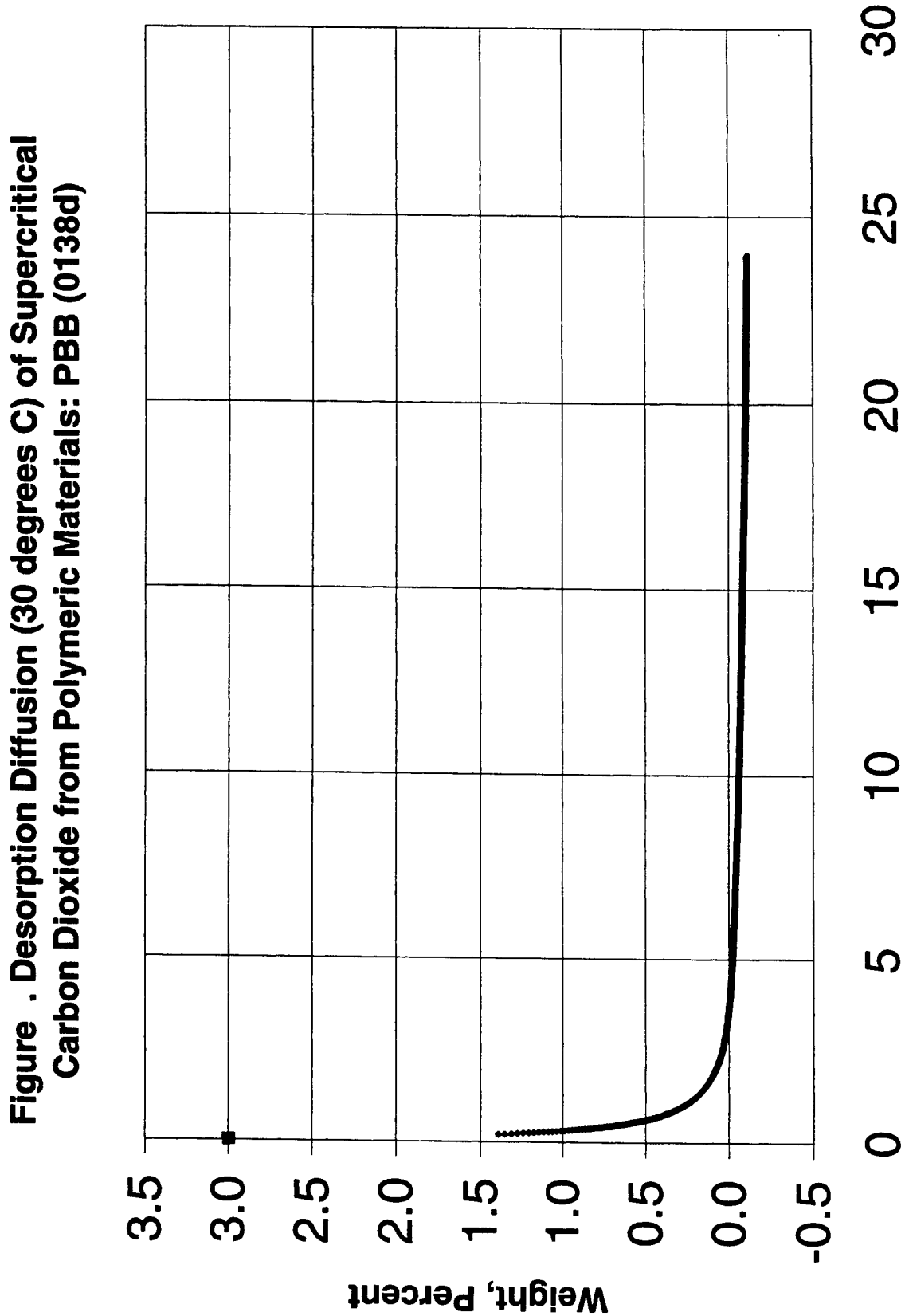


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PBB (0138d)
Weight, Percent
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
0
5
10
15
20
25
30
Time, Hours

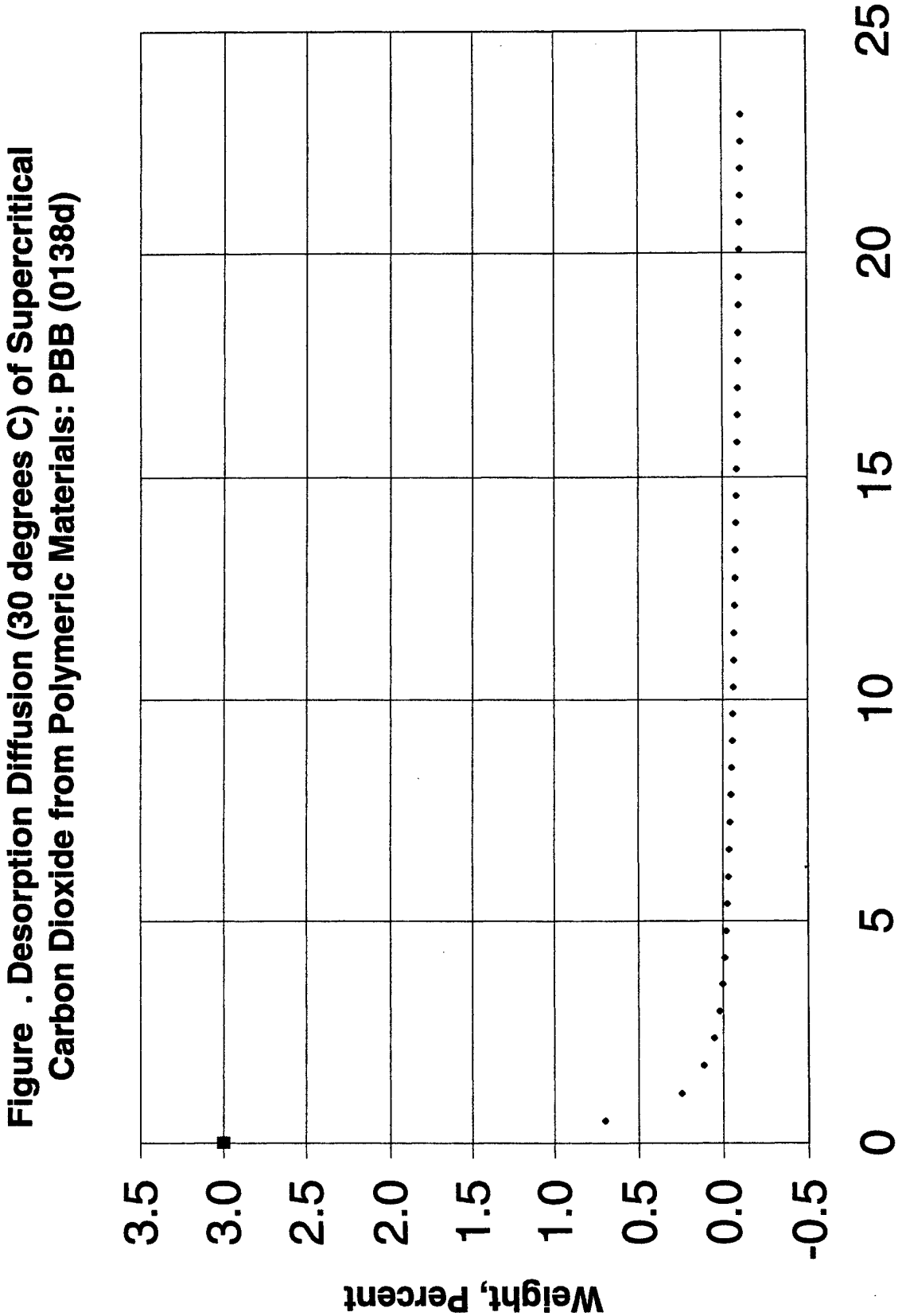
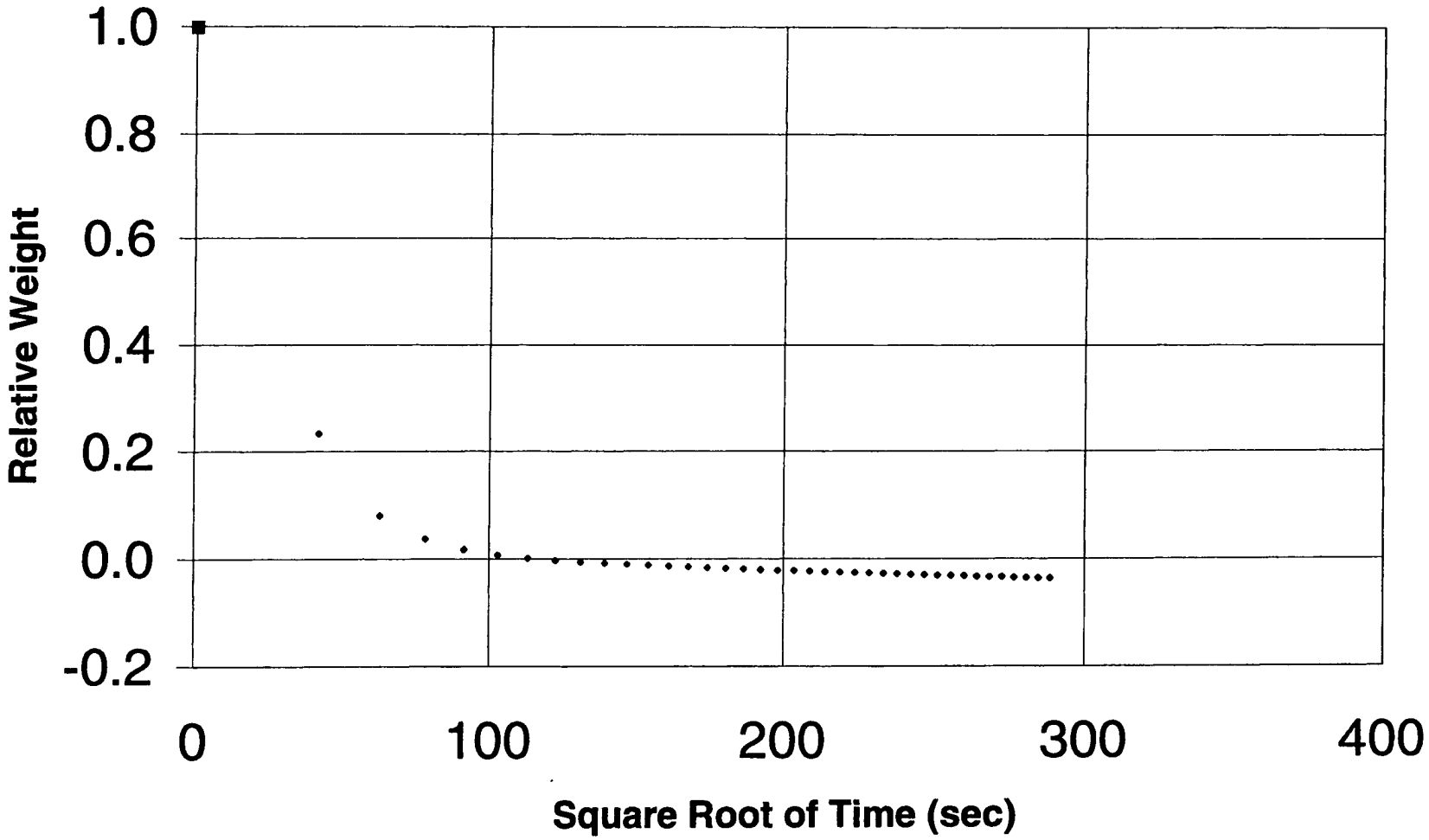


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PBB (0138d)

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PBB (0138d)



TGA Time, min	Temp., deg C	TGA Wt., mg	TGA Time, sec	Adjusted Time, sec	Adjusted Time, hr	SQRT Adj. Time, sec	Wt. Loss, %	Fractional Wt. Loss	Wt. @ Zero Time, mg	Wt. @ Zero Time, %	TGA Dry Wt., mg	Adjustment to TGA Time, sec	Hardness Scale
A	B	C	D	E	F	G	H	I	J	K	L	M	N
18.250	29.999	68.827	1095.000	1780.000	0.494	42.19	0.699	0.233	70.40	3.001	68.349	685	Shore A
54.923	29.999	68.516	3295.380	3980.380	1.106	63.09	0.244	0.081					
91.618	30.000	68.427	5497.080	6182.080	1.717	78.63	0.114	0.038					Pre Exposure
128.308	30.000	68.386	7698.480	8383.480	2.329	91.56	0.054	0.018	Formulae Used for Analysis of Data				Hardness
164.995	30.000	68.364	9899.700	10584.700	2.940	102.88	0.022	0.007	Uppercase letters refer to columns				65.9
201.697	30.000	68.351	12101.820	12786.820	3.552	113.08	0.003	0.001	Lowercase n refers to row, beginning with n=4				
238.392	30.001	68.343	14303.520	14988.520	4.163	122.43	-0.009	-0.003	----------				Post Desorption
275.072	30.000	68.337	16504.320	17189.320	4.775	131.11	-0.018	-0.006	Dn = (An * 60)				Hardness
311.783	30.000	68.332	18706.980	19391.980	5.387	139.26	-0.025	-0.008	En = (Dn + M4)				67.8
348.510	30.000	68.328	20910.600	21595.600	5.999	146.95	-0.031	-0.010	Fn = (En / 3600)				
385.211	30.000	68.325	23112.660	23797.660	6.610	154.26	-0.036	-0.012	Gn = SQRT (En)				Change in
421.910	30.000	68.321	25314.600	25999.600	7.222	161.24	-0.041	-0.014	Hn = (((Cn - L4) / L4) * 100)				Hardness, %
458.737	30.001	68.318	27524.220	28209.220	7.836	167.96	-0.045	-0.015	In = ((Cn - L4) / (J4 - L4))				2.88
495.466	30.000	68.315	29727.960	30412.960	8.448	174.39	-0.050	-0.017	K4 = (((J4 - L4) / L4) * 100)				
532.159	30.000	68.312	31929.540	32614.540	9.060	180.59	-0.054	-0.018	N16 = (((N12 – N8) /N8) * 100)				
568.842	30.000	68.310	34130.520	34815.520	9.671	186.59	-0.058	-0.019					
605.517	30.000	68.307	36331.020	37016.020	10.282	192.40	-0.061	-0.020					
642.214	30.000	68.305	38532.840	39217.840	10.894	198.03	-0.065	-0.022	Source binary TA data file : pbb0138d.01				
678.898	30.000	68.303	40733.880	41418.880	11.505	203.52	-0.067	-0.022	14 lines in the parameter block				
715.596	30.000	68.301	42935.760	43620.760	12.117	208.86	-0.070	-0.023	3 channels of data				
752.319	30.000	68.300	45139.140	45824.140	12.729	214.07	-0.072	-0.024	----------				
789.039	30.000	68.298	47342.340	48027.340	13.341	219.15	-0.075	-0.025	Run 41				
825.791	30.000	68.296	49547.460	50232.460	13.953	224.13	-0.078	-0.026	Module TGA Aluminum Pans				
862.502	30.000	68.294	51750.120	52435.120	14.565	228.99	-0.081	-0.027	Sample PBrIB-IP 43 Mask SC02 0138D Disk				
899.199	30.001	68.292	53951.940	54636.940	15.177	233.75	-0.083	-0.028	Size 69.317 mg				
935.885	30.000	68.291	56153.100	56838.100	15.788	238.41	-0.085	-0.028	Method DESORPTION-Isothermal				
972.560	30.000	68.289	58353.600	59038.600	16.400	242.98	-0.088	-0.029	Operator BSI				
1009.237	30.001	68.287	60554.220	61239.220	17.011	247.47	-0.090	-0.030	Comment .336"x.042",HP@1400x50,Dry:DS-68.4 M-68.28 TG-68.349 ET: 11:25				
1045.915	30.000	68.286	62754.900	63439.900	17.622	251.87	-0.093	-0.031	Nsig 3				
1082.614	30.000	68.284	64956.840	65641.840	18.234	256.21	-0.095	-0.032	Sig1 Time (min)				
1119.318	30.000	68.283	67159.080	67844.080	18.846	260.47	-0.097	-0.032	Sig2 Temperature (øC)				
1156.067	30.000	68.282	69364.020	70049.020	19.458	264.67	-0.099	-0.033	Sig3 Weight (mg)				
1192.838	30.000	68.280	71570.280	72255.280	20.071	268.80	-0.101	-0.034	Kcell 1.0000				
1229.534	30.000	68.279	73772.040	74457.040	20.683	272.87	-0.103	-0.034	Date 17-May-00				
1266.229	30.000	68.277	75973.740	76658.740	21.294	276.87	-0.105	-0.035	Time 10:33				
1302.923	30.000	68.276	78175.380	78860.380	21.906	280.82	-0.107	-0.036					
1339.633	30.000	68.274	80377.980	81062.980	22.517	284.72	-0.109	-0.036					
1376.322	30.000	68.273	82579.320	83264.320	23.129	288.56	-0.111	-0.037					

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FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Polyisobutylene-isoprene PIB

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	11-1-1	TGA Filename:	pib0137d
Property Test Specification:	ASTM D471/D543		
Material Name:	Polyisobutylene-isoprene	Material Code:	PIB
Material Supplier:	Smithers Scientific	Material Class:	IIR
Monomer Source:	Polysar Rubber	Base Polymer (Lot. No.):	Butyl 301
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	1

Pre-Exposure Data

Measured Diameter (mm):	6.64	6.64	6.62	6.63	
Mean Diameter:	6.635		95% Confidence Level (CL):		0.015
Measured Thickness (mils):	41.00	41.00	40.40	40.30	
Mean Thickness:	40.675		95% Confidence Level (CL):		0.601
Initial Sample Weight (mg):	37.540				
Initial Durometer Hardness:	66.2	Scale: SHORE		A	

Sample Exposure Data

Exposure Date:	05/16/00	Time:	13:23:00
Removal Date:	05/16/00	Time:	13:38:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	40.50
Weight Gain (mg):	2.96	Percent Weight Gain:	7.88
Final Durometer Hardness After Desorption:	67.7	Percent Hardness Change:	2.3

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.000	95% CL:	0.0014
Time Lapse Between Sample Exposure and Sample Desorption (sec):			545
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			37.590
Sample Extracted (mg):	-0.05	Solubility Corrected for Extractables (mg):	2.96
Sample Extracted (%):	-0.13	Solubility Corrected for Extractables (%):	7.88

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm2/sec):			7.7950E-07
Range Including 0,1 Intercept, Relative Weight Fraction:			1.00 - 0.40
Linear Range of Desorption, Relative Weight Fraction:			0.55 - 0.40
Slope:	-1.9286E-02	X-axis Intercept:	5.1799E+01
R Square:	0.99988	Y-axis Intercept:	9.9897E-01

Low Concentration Diffusion Coefficient (cm2/sec):			3.0844E-11
Linear Range of Desorption, Relative Weight Fraction:			0.04 - 0.02
Slope:	-1.2131E-04	X-axis Intercept:	3.3677E+02
R Square:	0.75955	Y-axis Intercept:	4.0855E-02

Wt. @ Zero Time, mg K 40.50	Wt. @ Zero Time, % L 7.885	Adjustment to TGA Time, sec M 545	Hardness Shore Scale N A
TGA Dry Wt., mg 37.540	Equil. Wt. Of Desorb. Sample 37.59	Min. Wt. Used For FDC, mg. 37.540	Pre Exposure Hardness 66.2
High Conc. DC, cm2/sec 7.7950E-07	Low Conc. DC, cm2/sec 3.0844E-11	Total Liquid Sorbed, mg. 2.960	Post Desorption Hardness 67.7
R Square 0.99988	R Square 0.75955		Change in Hardness, % 2.3
X Intercept 51.80	X Intercept 336.8		Mean Thickness, cm. 0.1033
Y Intercept 0.99897	Y Intercept 0.04085		**plb0137d**
Y Intercept as Wt., mg. 40.458	X Intercept as Time, hrs. 31.5	X Intercept as Time, min. 189.0	X Intercept as Time, days 1.3
		Max. TGA Wt., (orig data file) 39.176	TGA Wt. At 20 min. Adjustment 38.562
		Sorption @ 7-12 min., mg 1.64	Sorption @ 20 min., mg 1.02
		Sorption @ 7-12 min., % 4.36	Sorption @ 20 min., % 2.72
		Rel. Error (%) of 7-12 min. Sorp. -44.7	Rel. Error (%) of 20 min. Sorp -65.5

TEMPERATURE STATISTICS

Column1	
Mean	29.99950594
Standard Error	0.000739013
Median	30
Mode	29.999
Standard Deviation	0.029551293
Sample Variance	0.000873279
Kurtosis	429.8792472
Skewness	-17.48325949
Range	0.988
Minimum	29.192
Maximum	30.18
Sum	47969.21
Count	1599
Confidence Level(95.0%)	0.001449536

DIAMETER STATISTICS

	Column1	
	Mean	6.6325
	Standard Error	0.00478714
	Median	6.635
	Mode	6.64
	Standard Deviation	0.00957427
	Sample Variance	9.1667E-05
	Kurtosis	-1.2892562
	Skewness	-0.854563
	Range	0.02
	Minimum	6.62
	Maximum	6.64
ND/value	Sum	26.53
ND/value	Count	4
A/D	Confidence Level(95.0%)	0.01523482

THICKNESS STATISTICS

	Column1	
	Mean	40.675
	Standard Error	0.18874586
	Median	40.7
	Mode	41
	Standard Deviation	0.37749172
	Sample Variance	0.1425
	Kurtosis	-5.6522007
Butyl 301	Skewness	-0.0604173
pib0137d	Range	0.7
	Minimum	40.3
	Maximum	41
	Sum	162.7
	Count	4
	Confidence Level(95.0%)	0.60067413

HIGH CONCENTRATION DIFFUSION COEFFICIENT

pib0137d

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999940638
R Square	0.999881279
Adjusted R Square	0.999872798
Standard Error	0.00158408
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.295870343	0.295870343	117909.114	6.96392E-29
Residual	14	3.51303E-05	2.50931E-06		
Total	15	0.295905474			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.998966023	0.001504051	664.1835269	6.7905E-33	0.995740151	1.002191895
X Variable 1	-0.019285518	5.61639E-05	-343.3789662	6.9639E-29	-0.019405978	-0.019165058

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

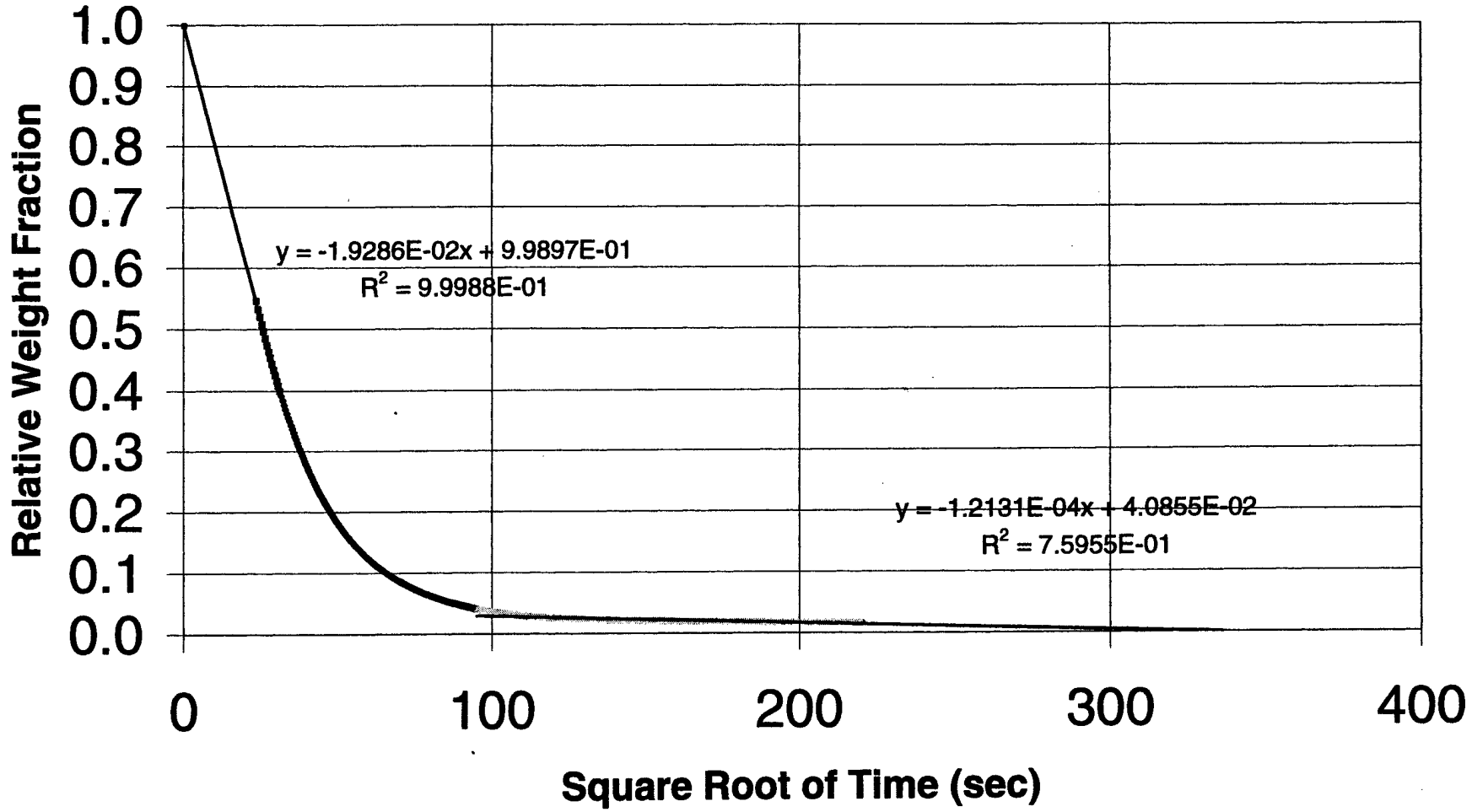
Regression Statistics	
Multiple R	0.871521284
R Square	0.759549349
Adjusted R Square	0.759366357
Standard Error	0.002404989
Observations	1316

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.024007766	0.024007766	4150.73879	0
Residual	1314	0.007600142	5.78397E-06		
Total	1315	0.031607908			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.040854876	0.000319502	127.8703396	0	0.040228086	0.041481667
X Variable 1	-0.000121314	1.88299E-06	-64.42622748	0	-0.000125008	-0.00011762

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PIB (0137d)



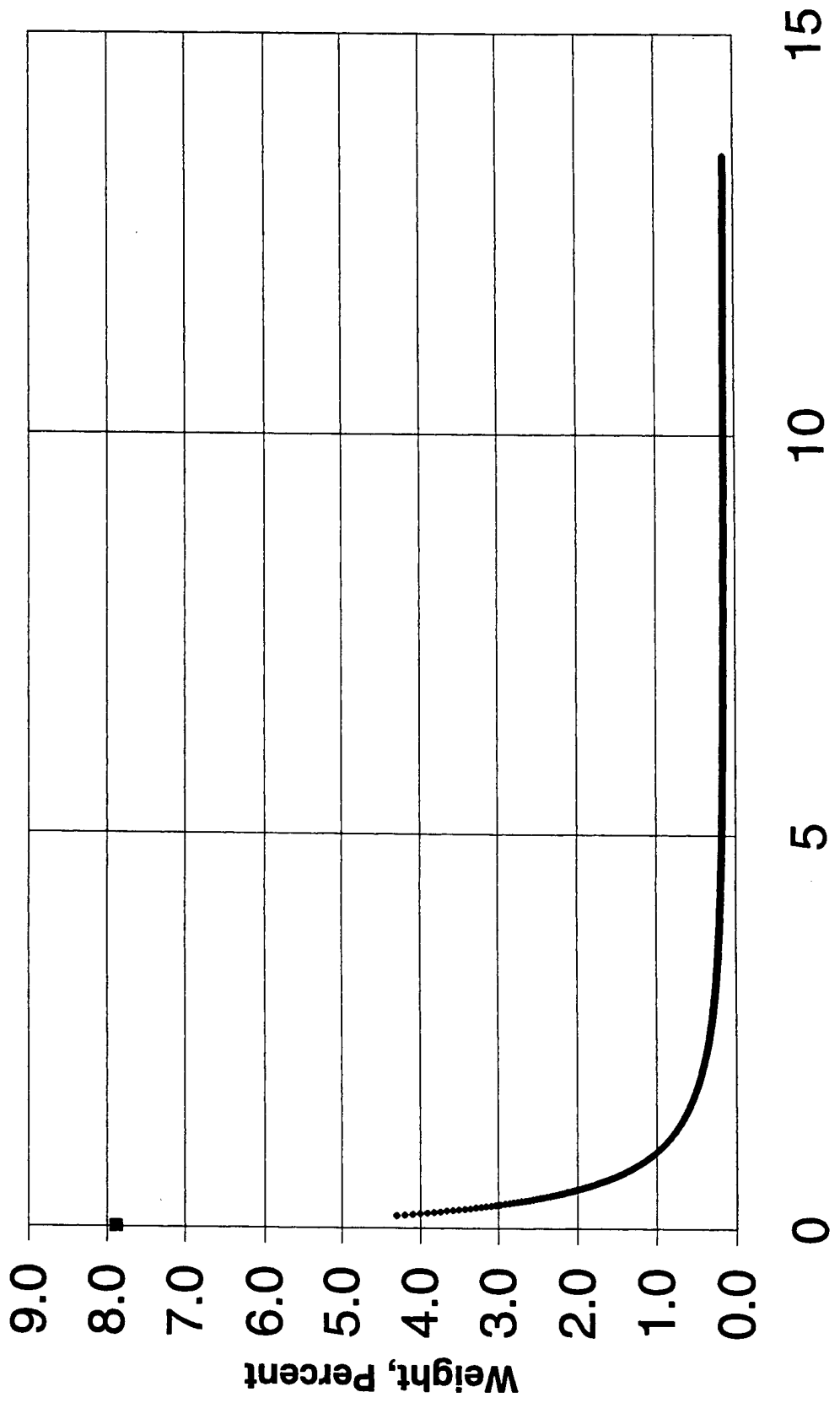


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PIB (0137d)

Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PIB (0137d)

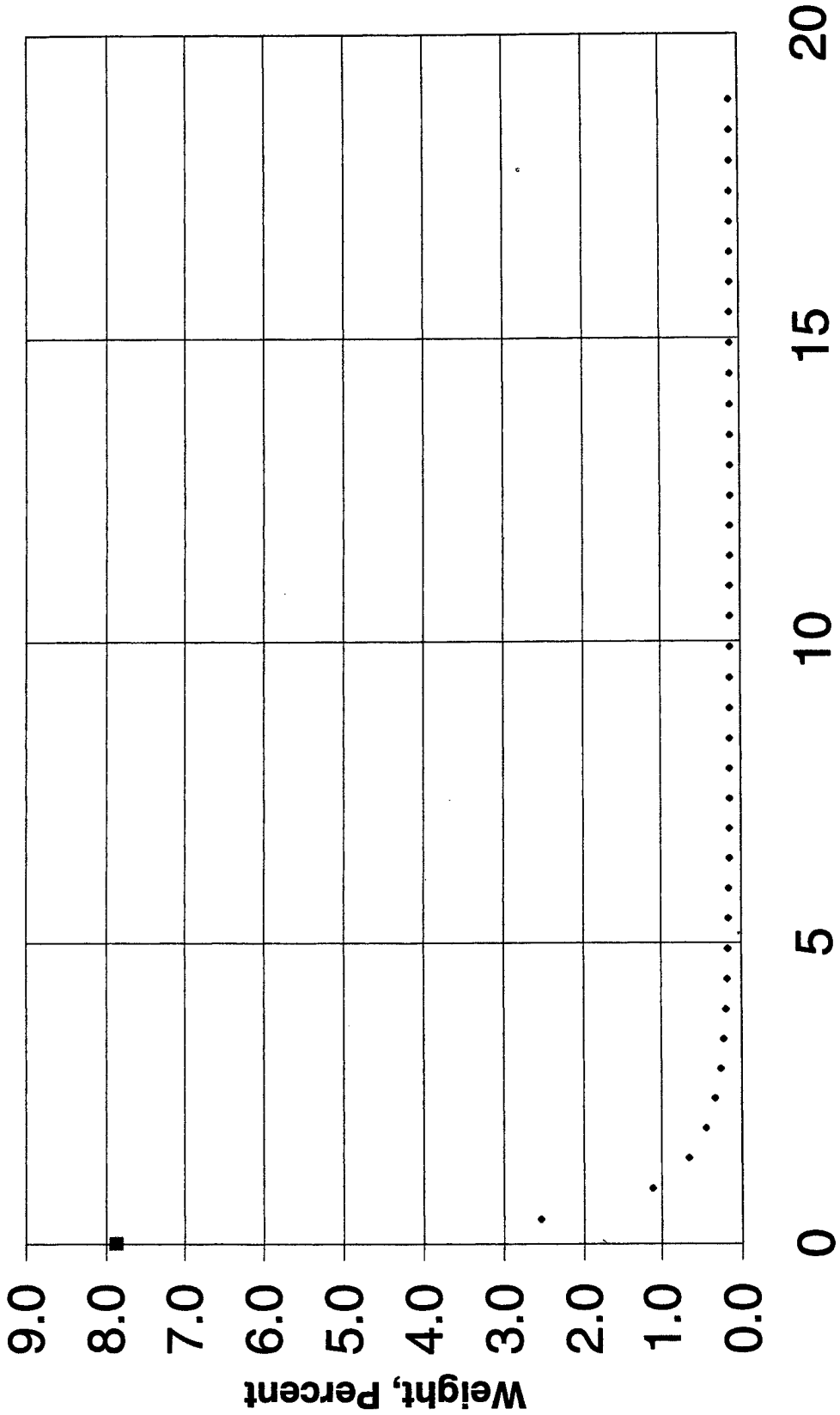
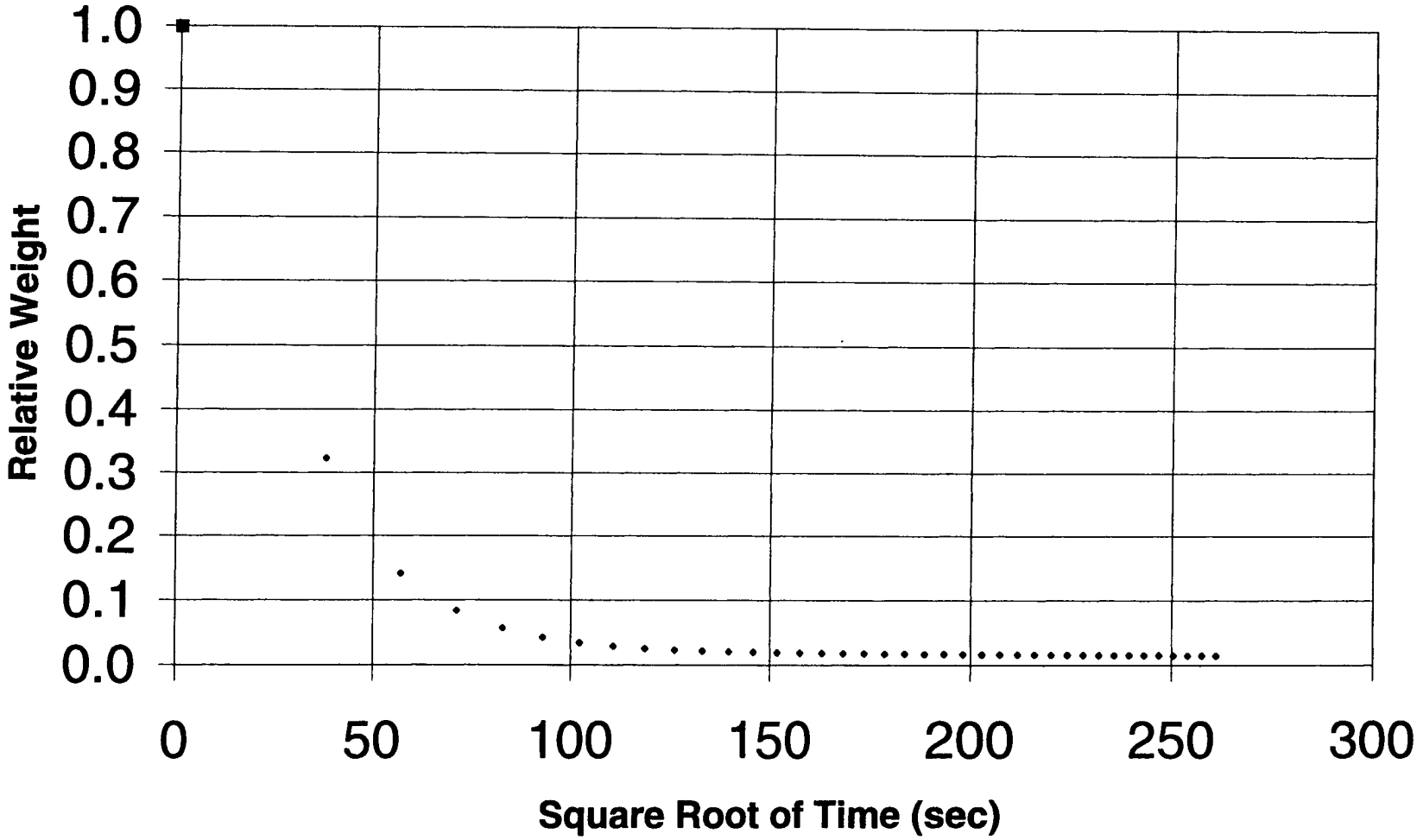


Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PIB (0137d)



TGA Time, min	Temp., deg C	TGA Wt., mg	TGA Time, sec	Adjusted Time, sec	Adjusted Time, hr	SQRT Adj. Time, sec	Wt. Loss, %	Fractional Wt. Loss	Wt. @ Zero Time, mg	Wt. @ Zero Time, %	TGA Dry Wt., mg	Adjustment to TGA Time, sec	Hardness Scale
A	B	C	D	E	F	G	H	I	J	K	L	M	N
14.916	29.982	38.498	894.960	1439.960	0.400	37.95	2.543	0.323	40.50	7.876	37.543	545	Shore A
44.918	30.000	37.960	2695.080	3240.080	0.900	56.92	1.111	0.141					
74.933	30.001	37.790	4495.980	5040.980	1.400	71.00	0.658	0.083					Pre Exposure
104.958	30.000	37.711	6297.480	6842.480	1.901	82.72	0.446	0.057	Formulae Used for Analysis of Data				Hardness
134.974	30.001	37.668	8098.440	8643.440	2.401	92.97	0.332	0.042	Uppercase letters refer to columns				66.2
164.992	30.000	37.642	9899.520	10444.520	2.901	102.20	0.264	0.034	Lowercase n refers to row, beginning with n=4				
195.016	30.000	37.627	11700.960	12245.960	3.402	110.66	0.223	0.028	----------				Post Desorption
225.039	30.000	37.617	13502.340	14047.340	3.902	118.52	0.197	0.025	Dn = (An * 60)				Hardness
255.043	30.000	37.611	15302.580	15847.580	4.402	125.89	0.181	0.023	En = (Dn + M4)				67.7
285.051	30.001	37.607	17103.060	17648.060	4.902	132.85	0.169	0.021	Fn = (En / 3600)				
315.067	30.000	37.603	18904.020	19449.020	5.403	139.46	0.161	0.020	Gn = SQRT (En)				Change in
345.107	30.000	37.601	20706.420	21251.420	5.903	145.78	0.155	0.020	Hn = (((Cn - L4) / L4) * 100)				Hardness, %
375.139	30.000	37.599	22508.340	23053.340	6.404	151.83	0.150	0.019	In = ((Cn - L4) / (J4 - L4))				2.27
405.184	30.000	37.598	24311.040	24856.040	6.904	157.66	0.146	0.019	K4 = (((J4 - L4) / L4) * 100)				
435.194	30.000	37.597	26111.640	26656.640	7.405	163.27	0.143	0.018	N16 = (((N12 – N8) /N8) * 100)				
465.256	30.000	37.596	27915.360	28460.360	7.906	168.70	0.141	0.018					
495.331	30.000	37.595	29719.860	30264.860	8.407	173.97	0.139	0.018					
525.358	30.000	37.594	31521.480	32066.480	8.907	179.07	0.137	0.017	Source binary TA data file : pib0137d.01				
555.390	30.000	37.594	33323.400	33868.400	9.408	184.03	0.135	0.017	14 lines in the parameter block				
585.407	30.000	37.593	35124.420	35669.420	9.908	188.86	0.133	0.017	3 channels of data				
615.415	30.000	37.593	36924.900	37469.900	10.408	193.57	0.132	0.017	----------				
645.425	30.000	37.592	38725.500	39270.500	10.908	198.17	0.130	0.017	Run 40				
675.468	30.000	37.591	40526.080	41073.080	11.409	202.66	0.128	0.016	Module TGA Aluminum Pans				
705.488	30.000	37.591	42329.280	42874.280	11.910	207.06	0.127	0.016	Sample PIB40 Glove SCO2 0137D Disk .25"				
735.506	30.000	37.590	44130.360	44675.360	12.410	211.37	0.126	0.016	Size 39.176 mg				
765.525	30.000	37.590	45931.500	46476.500	12.910	215.58	0.124	0.016	Method DESORPTION-Isothermal				
795.537	30.000	37.589	47732.220	48277.220	13.410	219.72	0.123	0.016	Operator bsi				
825.559	30.000	37.589	49533.540	50078.540	13.911	223.78	0.123	0.016	Comment .263"x.039",HP@1400x50,Dry:DS-37.6 M-37.44 TG-37.543 ET: 9:05				
855.621	30.000	37.589	51337.260	51882.260	14.412	227.78	0.122	0.015	Nsig 3				
885.666	30.000	37.588	53139.960	53684.960	14.912	231.70	0.121	0.015	Sig1 Time (min)				
915.676	30.001	37.588	54940.560	55485.560	15.413	235.55	0.120	0.015	Sig2 Temperature (øC)				
945.693	30.000	37.588	56741.580	57286.580	15.913	239.35	0.119	0.015	Sig3 Weight (mg)				
975.726	30.000	37.587	58543.560	59088.560	16.413	243.08	0.118	0.015	Kcell 1.0000				
1005.742	30.000	37.587	60344.520	60889.520	16.914	246.76	0.117	0.015	Date 16-May-00				
1035.781	30.000	37.587	62146.860	62691.860	17.414	250.38	0.117	0.015	Time 11:49				
1065.835	30.001	37.586	63950.100	64495.100	17.915	253.96	0.116	0.015					
1095.857	30.000	37.586	65751.420	66296.420	18.416	257.48	0.115	0.015					
1125.863	30.000	37.586	67551.780	68096.780	18.916	260.95	0.113	0.014					

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FIGURE . CHEMICAL-MATERIAL INTERACTION DATA SET:
Supercritical Carbon Dioxide and Polystyrene-butadiene PSB

Sorption, Desorption Diffusion, and Indentation Data Sets

Material Data

Test Reference Number:	13-1-1	TGA Filename:	psb0140d
Property Test Specification:	ASTM D471/D543		
Material Name:	Polystyrene-butadiene	Material Code:	PSB
Material Supplier:	The Resinkit Company	Material Class:	TP
Monomer Source:	Resin Kit #8	Base Polymer (Lot. No.):	Unknown
Exposure Liquid:	Supercritical Carbon Dioxide	Replicate Number:	1

Pre-Exposure Data

Measured Diameter (mm):	9.84	9.74	9.76	9.85	
Mean Diameter:	9.800		95% Confidence Level (CL):		0.088
Measured Thickness (mils):	74.70	74.70	76.20	74.50	
Mean Thickness:	75.025		95% Confidence Level (CL):		1.255
Initial Sample Weight (mg):	142.020				
Initial Durometer Hardness:	63.6	Scale: SHORE	D		

Sample Exposure Data

Exposure Date:	05/19/00	Time:	11:23:00
Removal Date:	05/19/00	Time:	11:38:00
Total Exposure Time (h:m:s):	00:15:00	Weight of Sample After Exposure (mg):	148.70
Weight Gain (mg):	6.68	Percent Weight Gain:	4.70
Final Durometer Hardness After Desorption:	45.8	Percent Hardness Change:	-28.0

Desorption Experiment

Mean Temperature of Desorption Experiment (setpoint = 30 deg C):	30.001	95% CL:	0.0004
Time Lapse Between Sample Exposure and Sample Desorption (sec):			610
Equilibrium Weight of Desorbed Sample at 30 deg C (mg):			142.000
Sample Extracted (mg):	0.02	Solubility Corrected for Extractables (mg):	6.70
Sample Extracted (%):	0.01	Solubility Corrected for Extractables (%):	4.72

Diffusion Coefficient Data: Fick's Law

High Concentration Diffusion Coefficient (cm2/sec):			9.7266E-07
Range Including 0,1 Intercept, Relative Weight Fraction:			1.00 - 0.54
Linear Range of Desorption, Relative Weight Fraction:			0.67 - 0.54
Slope:	-1.1680E-02	X-axis Intercept:	8.5039E+01
R Square:	0.99872	Y-axis Intercept:	9.9321E-01

Low Concentration Diffusion Coefficient (cm2/sec):			1.4751E-10
Linear Range of Desorption, Relative Weight Fraction:			0.02 - 0.00
Slope:	-1.4383E-04	X-axis Intercept:	2.9524E+02
R Square:	0.82883	Y-axis Intercept:	4.2465E-02

Wt. @ Zero Time, mg K 148.70	Wt. @ Zero Time, % L 4.704	Adjustment to TGA Time, sec M 610	Hardness Shore Scale N D
TGA Dry Wt., mg 142.020	Equil. Wt. Of Desorb. Sample 142.00	Min. Wt. Used For FDC, mg. 142.000	Pre Exposure Hardness 63.6
High Conc. DC, cm2/sec 9.7266E-07	Low Conc. DC, cm2/sec 1.4751E-10	Total Liquid Sorbed, mg. 6.680	Post Desorption Hardness 45.8
R Square 0.99872	R Square 0.82883		Change in Hardness, % -28.0
X Intercept 85.04	X Intercept 295.2		Mean Thickness, cm. 0.1906
Y Intercept 0.99321	Y Intercept 0.04247		
Y Intercept as Wt., mg. 147.691	X Intercept as Time, hrs. 24.2	X Intercept as Time, min. 145.3	**psb0140d** X Intercept as Time, days 1.0
		Max. TGA Wt., (orig data file) 146.740	TGA Wt. At 20 min. Adjustment 145.935
		Sorption @ 7-12 min., mg 4.72	Sorption @ 20 min., mg 3.91
		Sorption @ 7-12 min., % 3.32	Sorption @ 20 min., % 2.76
		Rel. Error (%) of 7-12 min. Sorp. -29.3	Rel. Error (%) of 20 min. Sorp -41.4

TEMPERATURE STATISTICS

Column1	
Mean	30.0009317
Standard Error	0.000200313
Median	30
Mode	30
Standard Deviation	0.011080771
Sample Variance	0.000122783
Kurtosis	266.4820057
Skewness	15.10275641
Range	0.281
Minimum	29.943
Maximum	30.224
Sum	91802.851
Count	3060
Confidence Level(95.0%)	0.000392762

DIAMETER STATISTICS

	Column1	
	Mean	9.7975
	Standard Error	0.02780138
	Median	9.8
	Mode	#N/A
	Standard Deviation	0.05560276
	Sample Variance	0.00309167
	Kurtosis	-5.2112089
	Skewness	-0.0828945
	Range	0.11
	Minimum	9.74
	Maximum	9.85
ND/value	Sum	39.19
ND/value	Count	4
A/D	Confidence Level(95.0%)	0.08847648

THICKNESS STATISTICS

	Column1	
	Mean	75.025
	Standard Error	0.39449335
	Median	74.7
	Mode	74.7
	Standard Deviation	0.78898669
	Sample Variance	0.6225
	Kurtosis	3.74193965
Unknown	Skewness	1.91237109
psb0140d	Range	1.7
	Minimum	74.5
	Maximum	76.2
	Sum	300.1
	Count	4
	Confidence Level(95.0%)	1.25545507

HIGH CONCENTRATION DIFFUSION COEFFICIENT

psb0140d

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999359786
R Square	0.998719982
Adjusted R Square	0.998672574
Standard Error	0.003081805
Observations	29

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.200079147	0.200079147	21066.4595	1.34869E-40
Residual	27	0.000256433	9.49752E-06		
Total	28	0.20033558			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.993213175	0.002687177	369.6121544	1.4976E-51	0.987699547	0.998726802
X Variable 1	-0.011679524	8.04691E-05	-145.1428934	1.3487E-40	-0.011844633	-0.011514415

LOW CONCENTRATION DIFFUSION COEFFICIENT

SUMMARY OUTPUT

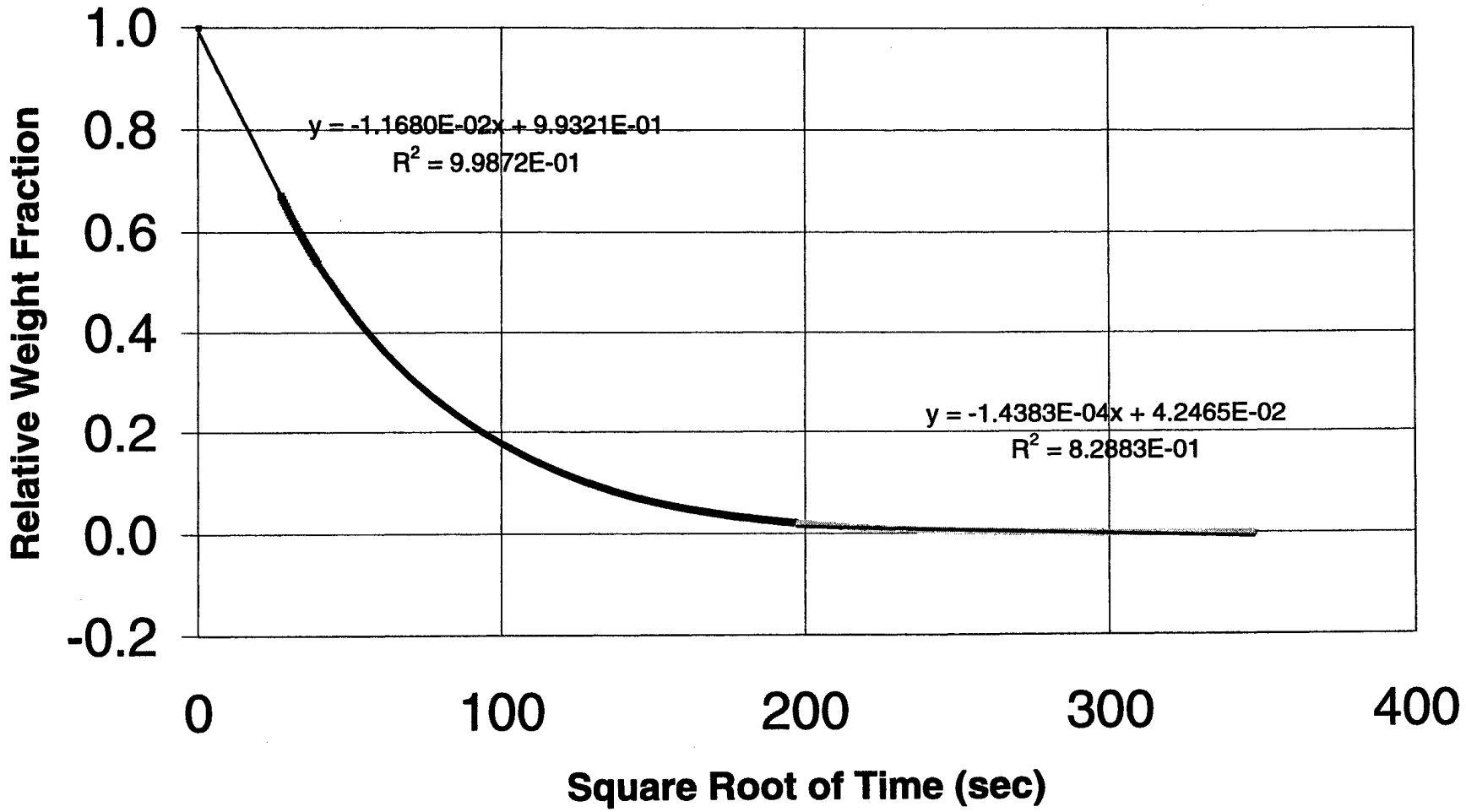
Regression Statistics	
Multiple R	0.910403271
R Square	0.828834116
Adjusted R Square	0.828738332
Standard Error	0.002281732
Observations	1789

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.045050986	0.045050986	8653.16461	0
Residual	1787	0.009303661	5.2063E-06		
Total	1788	0.054354647			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.04246542	0.000400887	105.9286262	0	0.041679163	0.043251677
X Variable 1	-0.000143832	1.54621E-06	-93.02238766	0	-0.000146864	-0.000140799

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PSB (0140d)



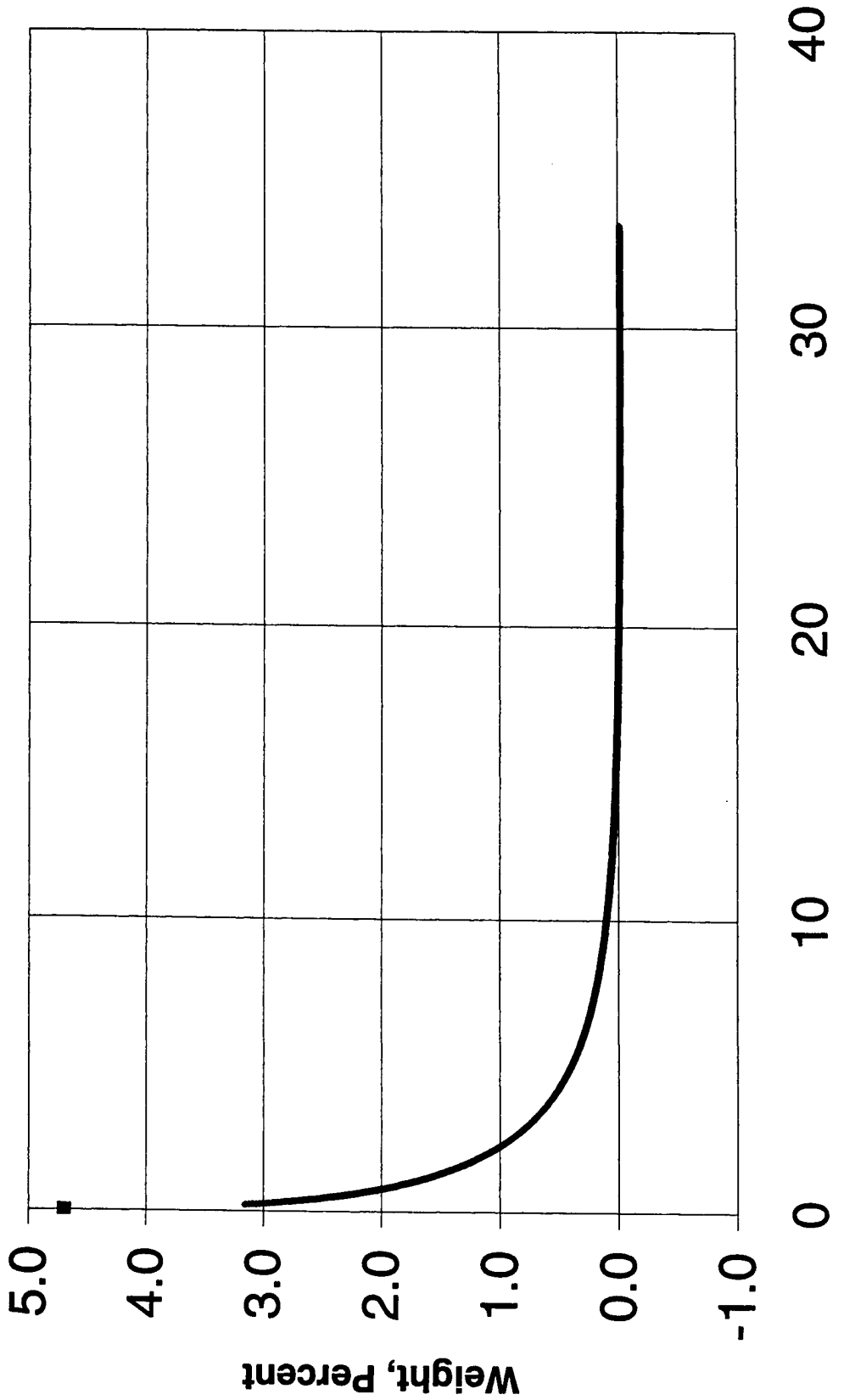
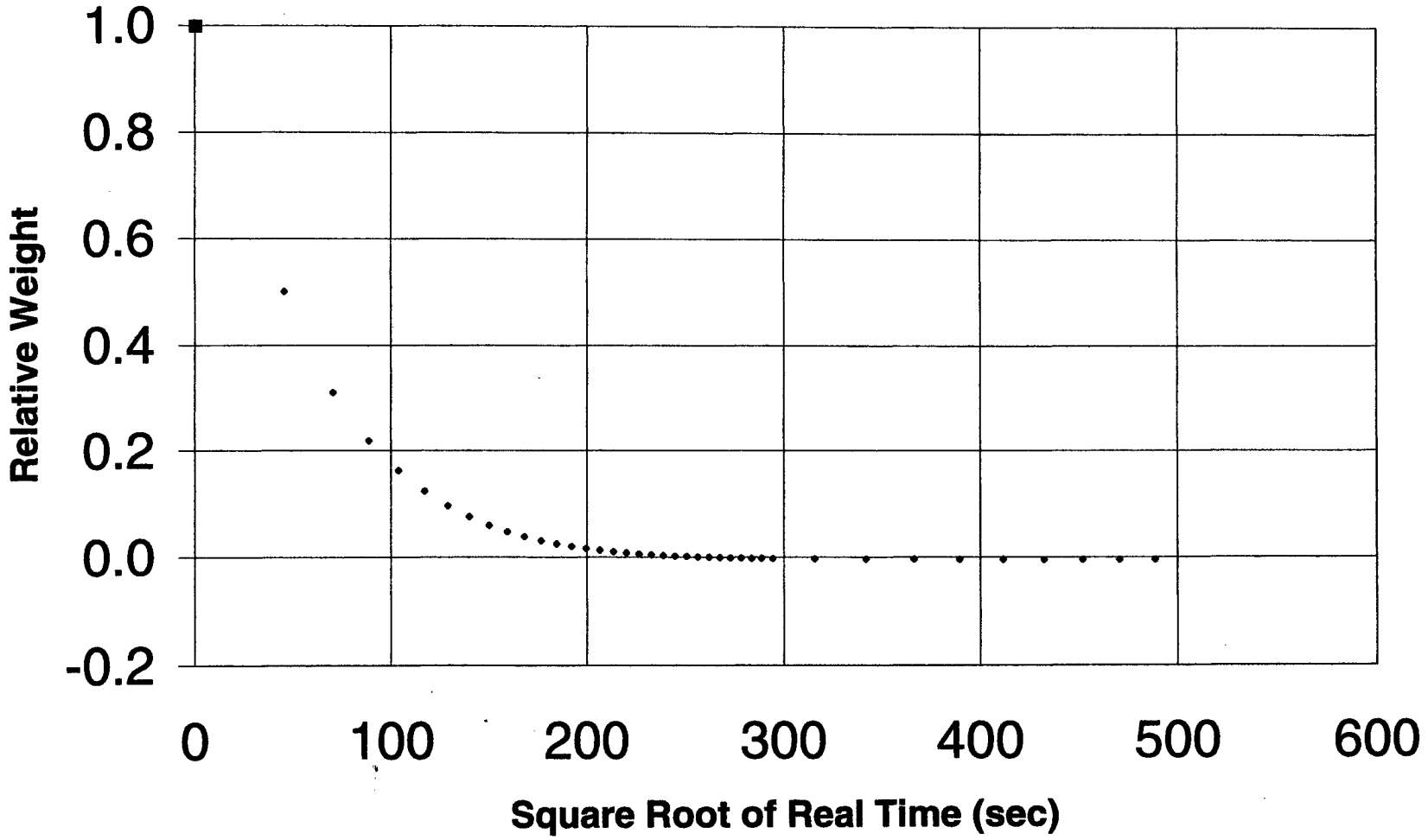


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PSB (0140d)

Figure . Fick's Law Plot of Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PSB (0140d)



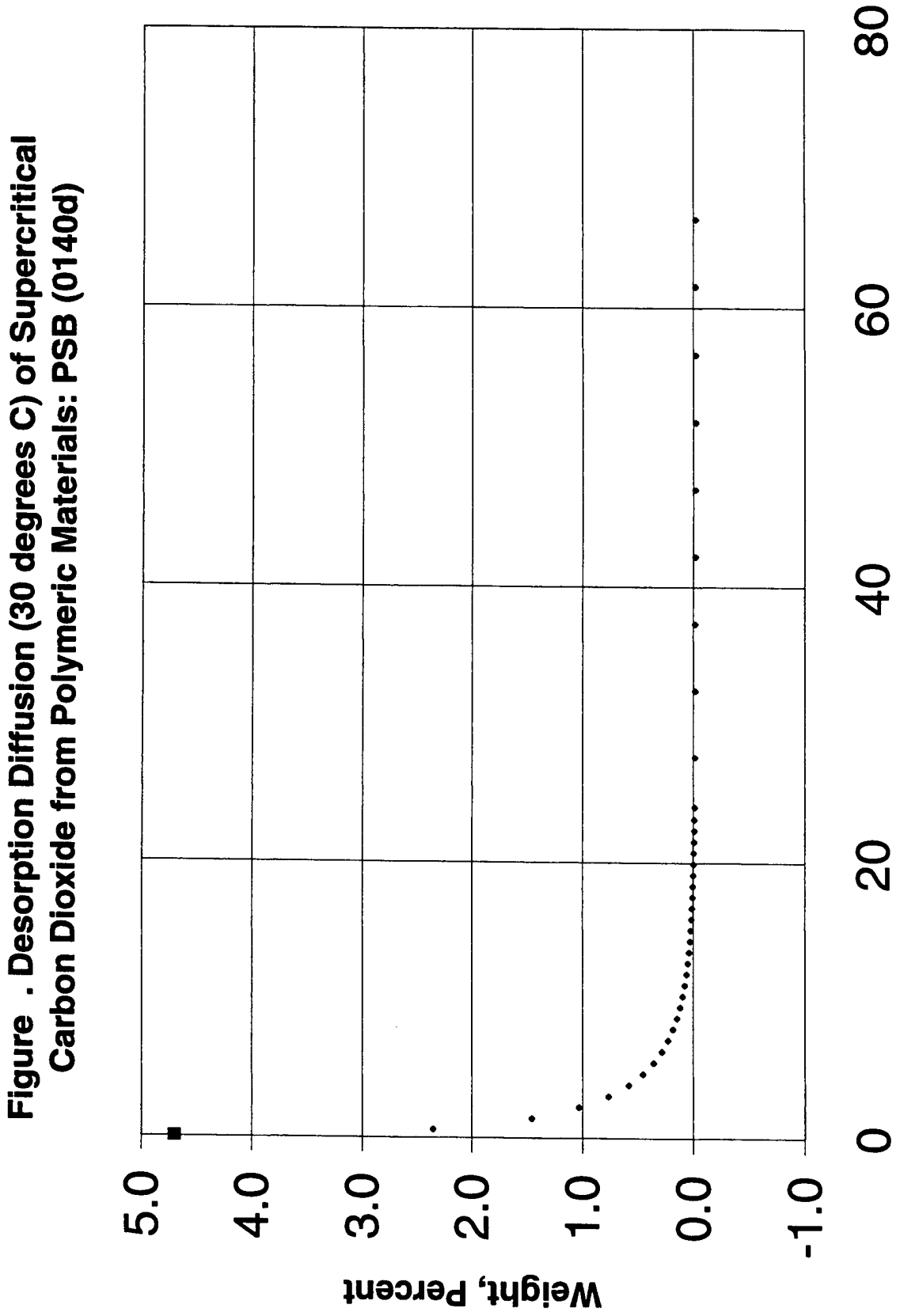


Figure . Desorption Diffusion (30 degrees C) of Supercritical Carbon Dioxide from Polymeric Materials: PSB (0140d)

TGA Time, min	Temp., deg C	TGA Wt., mg	TGA Time, sec	Adjusted Time, sec	Adjusted Time, hr	SQRT Adj. Time, sec	Wt. Loss, %	Fractional Wt. Loss	Wt. @ Zero Time, mg	Wt. @ Zero Time, %	TGA Dry Wt., mg	Adjustment to TGA Time, sec	Hardness Scale
A	B	C	D	E	F	G	H	I	J	K	L	M	N
24.085	30.006	145.366	1445.100	2055.100	0.571	45.33	2.357	0.501	148.70	4.704	142.019	610	Shore D
72.435	30.000	144.096	4346.100	4956.100	1.377	70.40	1.462	0.311					
120.829	30.000	143.486	7249.740	7859.740	2.183	88.66	1.033	0.220					Pre Exposure
169.205	30.000	143.107	10152.300	10762.300	2.990	103.74	0.766	0.163	Formulae Used for Analysis of Data				Hardness
217.575	30.001	142.848	13054.500	13664.500	3.796	116.90	0.584	0.124	Uppercase letters refer to columns				63.6
265.956	30.000	142.663	15957.360	16567.360	4.602	128.71	0.453	0.096	Lowercase n refers to row, beginning with n=4				
314.357	30.000	142.527	18861.420	19471.420	5.409	139.54	0.358	0.076	----------				Post Desorption
362.749	30.000	142.422	21764.940	22374.940	6.215	149.58	0.284	0.060	Dn = (An * 60)				Hardness
411.141	30.000	142.342	24668.460	25278.460	7.022	158.99	0.227	0.048	En = (Dn + M4)				45.8
459.507	30.000	142.279	27570.420	28180.420	7.828	167.87	0.183	0.039	Fn = (En / 3600)				
507.880	30.000	142.229	30472.800	31082.800	8.634	176.30	0.148	0.031	Gn = SQRT (En)				Change in
556.277	30.000	142.189	33376.620	33986.620	9.441	184.35	0.120	0.025	Hn = (((Cn - L4) / L4) * 100)				Hardness, %
604.642	30.000	142.157	36278.520	36888.520	10.247	192.06	0.097	0.021	In = ((Cn - L4) / (J4 - L4))				-27.99
653.007	30.000	142.130	39180.420	39790.420	11.053	199.48	0.078	0.017	K4 = (((J4 - L4) / L4) * 100)				
701.391	30.000	142.108	42083.460	42693.460	11.859	206.62	0.063	0.013	N16 = (((N12 – N8) /N8) * 100)				
749.829	30.000	142.089	44989.740	45599.740	12.667	213.54	0.049	0.010					
798.242	30.000	142.075	47894.520	48504.520	13.473	220.24	0.039	0.008					
846.654	30.000	142.062	50799.240	51409.240	14.280	226.74	0.030	0.006	Source binary TA data file : psb140d.01				
895.044	30.000	142.051	53702.640	54312.640	15.087	233.05	0.023	0.005	14 lines in the parameter block				
943.480	30.000	142.042	56608.800	57218.800	15.894	239.20	0.016	0.003	3 channels of data				
991.931	30.000	142.035	59515.860	60125.860	16.702	245.21	0.011	0.002	----------				
1040.304	30.001	142.029	62418.240	63028.240	17.508	251.05	0.007	0.001	Run 43				
1088.649	30.001	142.024	65318.940	65928.940	18.314	256.77	0.004	0.001	Module TGA Aluminum Pans				
1137.000	30.000	142.019	68220.000	68830.000	19.119	262.35	0.000	0.000	Sample PSB POLY(STYRENE-BUTADIENE) 140D				
1185.396	30.000	142.015	71123.760	71733.760	19.926	267.83	-0.003	-0.001	Size 146.740 mg				
1233.828	30.001	142.012	74029.680	74639.680	20.733	273.20	-0.005	-0.001	Method DESORPTION-Isothermal				
1282.196	30.000	142.009	76931.760	77541.760	21.539	278.46	-0.007	-0.001	Operator ws				
1330.587	30.001	142.007	79835.220	80445.220	22.346	283.63	-0.008	-0.002	Comment .384"x.075",HP@1400x50,Dry:DS142.0 M-142.17 TG142.019 ET:10:10				
1378.971	30.001	142.005	82738.260	83348.260	23.152	288.70	-0.010	-0.002	Nsig 3				
1433.396	30.001	142.003	86003.760	86613.760	24.059	294.30	-0.011	-0.002	Sig1 Time (min)				
1650.667	30.000	141.998	99040.020	99650.020	27.681	315.67	-0.015	-0.003	Sig2 Temperature (øC)				
1940.680	30.000	141.995	116440.800	117050.800	32.514	342.13	-0.017	-0.004	Sig3 Weight (mg)				
2230.686	30.001	141.994	133841.160	134451.160	37.348	366.68	-0.018	-0.004	Kcell 1.0000				
2520.688	30.001	141.993	151241.280	151851.280	42.181	389.68	-0.018	-0.004	Date 19-May-00				
2810.691	30.000	141.992	168641.460	169251.460	47.014	411.40	-0.019	-0.004	Time 11:49				
3100.701	30.000	141.990	186042.060	186652.060	51.848	432.03	-0.020	-0.004					
3390.701	30.000	141.989	203442.060	204052.060	56.681	451.72	-0.021	-0.004					
3680.703	30.000	141.988	220842.180	221452.180	61.514	470.59	-0.022	-0.005					
3970.735	30.000	141.988	238244.100	238854.100	66.348	488.73	-0.022	-0.005					