

AD-A064 683

MINISTRY OF DEFENCE LONDON (ENGLAND) DIRECTORATE OF --ETC F/G 11/2
THE EFFECT OF WEATHERING ON THE MODULUS OF RUPTURE OF VHR2A AND--ETC(U)
SEP 78 N S CORNEY

UNCLASSIFIED

DR-MAT-210

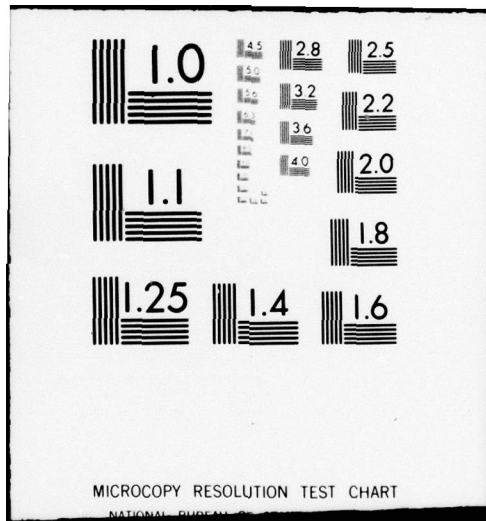
DRTC-RR-66315

NI

1 OF 1
AD
A064683



END
DATE
FILMED
4-79
DDC



MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS-1963-A

1110

AD A 064683

DDC FILE COPY

DDC
FEB 1

LEVEL II

DR Mat Report No 210

6

THE EFFECT OF WEATHERING ON THE MODULUS OF RUPTURE OF VHR2A AND VHR3A GLASSES (GLAVERBEL-MECANIVER SA)

AUTHOR - N. S. CORNEY

PROCUREMENT EXECUTIVE, MINISTRY OF DEFENCE
DIRECTORATE OF RESEARCH, MATERIALS

10

11 Sep 78

FOREWARD - Additional results are provided to those given earlier on the evaluation of these thin, high-strength glasses for aerospace applications. The programme was carried out by the British Glass Industry Research Association under MOD(PE) contract KS/1/0648/CB43A2. The work was under the direction of ADR Mat 2 and was monitored jointly by Mat R7, and ST3 Division of Structures Department RAE Farnborough.

The report contains no security classified information of overseas origin.

12/10p

14 DR-MAT-210

SUMMARY

There appears to be no detrimental effect on the modulus of rupture of specimens of VHR2A and VHR3A glasses after they had been exposed either completely or partially for periods up to four years on the roof of the BGIRA building in Sheffield.

18 DRIC

19 BR-66315

ACCESSION NO	
NTIS	Write Section <input checked="" type="checkbox"/>
DDC	Read Section <input type="checkbox"/>
ORANGE	<input type="checkbox"/>
JUSTIFICATION	
BY	
DISTRIBUTION/AVAILABILITY CODE	
Dist. AVAIL. and/or SPECIAL	
A	

DDC
RECEIVED
FEB 14 1979
D

79 02 02 042

407 962 UNLIMITED

506

1. INTRODUCTION

The evaluation of the VHR series of glasses offered by Glaverbel-Mecaniver SA has been described in an earlier report. ¹⁾ The first results of a series of exposures aimed at investigating the effect of weathering upon these glasses were given in that report; the present report summarises all the results obtained over the 4 year period of exposure.

The research programme was carried out by the British Glass Industry Research Association under contract to the Procurement Executive, Ministry of Defence. Acknowledgement is made to Glaverbel-Mecaniver SA for the provision of specimens. Appreciation is expressed of the efforts of the staff of BGIRA, who have carried out the experimental work and have collaborated closely at all stages of the programme. Members of the staff of Structures Department RAE Farnborough have willingly advised and assisted in the work.

2. SCOPE OF THE WEATHERING PROGRAMME

Groups of beam specimens of VHR2A and VHR3A glasses were exposed in "protected" and "exposed" situations for periods up to 4 years. At previously agreed intervals certain groups were removed for measurement of the modulus of rupture.

3. EXPERIMENTAL PROGRAMME

As described in the previous reports beam specimens of nominal dimensions 254 x 38 x 2mm were exposed mounted on two wooden racks on the roof of the BGIRA building, one batch being completely exposed to the elements while the other batch was partially protected by a plastic roof from direct exposure to rain etc. During exposure the major edges of the specimens were at 45° to the horizontal and the minor edges horizontal. The upper faces of the beams faced due south.

After each weathering period had elapsed, the respective test groups of specimens were removed to the laboratory, where they were carefully washed in warm soapy water in order to remove grit and grime adhering to their surfaces. Sellotape was then applied to both sides of each specimen in order to retain the fragments after testing under four-point bending (outer span 203mm and inner span 76mm) at a stress rate of approximately 5 MPa s⁻¹. The modulus of rupture was determined from the fracture load as described earlier.

4. RESULTS

The modulus of rupture data are summarised in Tables 1 and 2 and graphically in Figures 1 and 2 for VHR2A and VHR3A specimens respectively.

All beam specimens failed from their edges under the bending test.

The results show that there was no apparent effect of weathering on the modulus of rupture of either of these glasses. The variations which occurred between groups were probably due to statistical fluctuations in sampling.

5. CONCLUSIONS

There appeared to be no detrimental effect on the modulus of rupture of specimens of VHR2A and VHR3A glasses after they had been exposed either

UNLIMITED

completely or partially, for periods up to four years to weathering on the roof of the BGIRA building in Sheffield.

REFERENCES

1. The evaluation of VHR2A and VHR3A glasses (Glaverbel-Mecaniver SA) for aerospace applications.

N S CORNEY DR Mat Report No 198, (BR 44083), 1975

Weathered period	n	Mean MOR (MPa)	Range (MPa)	S.D. (MPa)	C.V.	95% C.L. (MPa)
3 months exposed	10	243	228-256	9.8	.040	7.2
3 months covered	10	247	230-270	12.7	.051	9.3
6 months exposed	10	246	228-258	10.1	.041	7.4
6 months covered	10	247	235-260	7.3	.030	5.3
1 year exposed	10	242	223-263	10.6	.044	7.7
1 year covered	10	241	226-254	10.2	.042	7.4
3 years exposed	9*	243	234-255	7.2	.030	5.5
3 years covered	10	252	232-268	11.6	.046	8.5

* One specimen cracked during removal from the weathering rack.

NB. All specimens failed from edges.

n - Number of specimens

SD - Standard deviation

CV - Coefficient of variation

CL - Confidence limit

TABLE 1 - SUMMARY OF FRACTURE TEST DATA FROM WEATHERED VHR 2A LATHS

Weathered period	n	Mean MOR (MPa)	Range (MPa)	S.D. (MPa)	C.V.	95% C.L. (MPa)
3 months exposed	10	234	222-245	7.6	.033	5.5
3 months covered	10	232	213-250	11.3	.049	8.2
6 months exposed	10	228	222-244	6.0	.026	4.4
6 months covered	10	238	220-257	12.5	.053	9.1
1 year exposed	10	229	195-250	15.2	.066	11.1
1 year covered	10	227	218-237	6.1	.027	4.5
2 years exposed	10	235	213-247	10.0	.043	7.3
2 years covered	10	229	196-242	13.5	.059	9.8
3 years exposed	10	225	216-232	5.6	.025	4.1
3 years covered	9*	223	214-232	5.5	.025	4.2
4 years exposed	10	230	223-238	5.5	.024	4.0
4 years covered	9*	234	225-249	8.2	.035	6.3

* One specimen had cracked whilst in the weathering rack.

NB. All specimens failed from edges.

n - Number of specimens

SD - Standard deviation

CV - Coefficient of variation

CL - Confidence limit

TABLE 2 - SUMMARY OF FRACTURE TEST DATA FROM WEATHERED VHR 3A LATHS

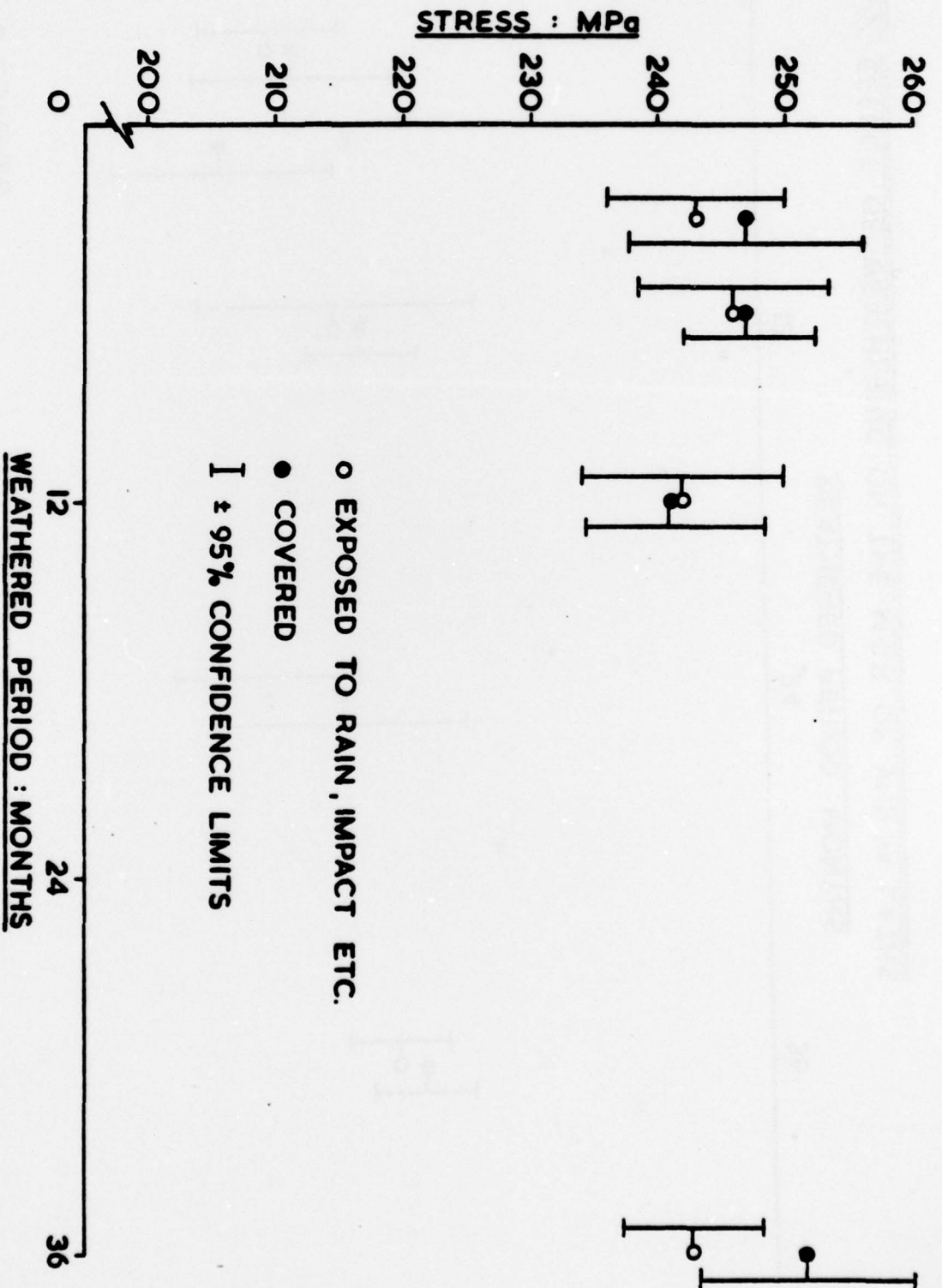


FIG. 1. EFFECT OF WEATHERING ON THE MOR OF VHR2A LATHS

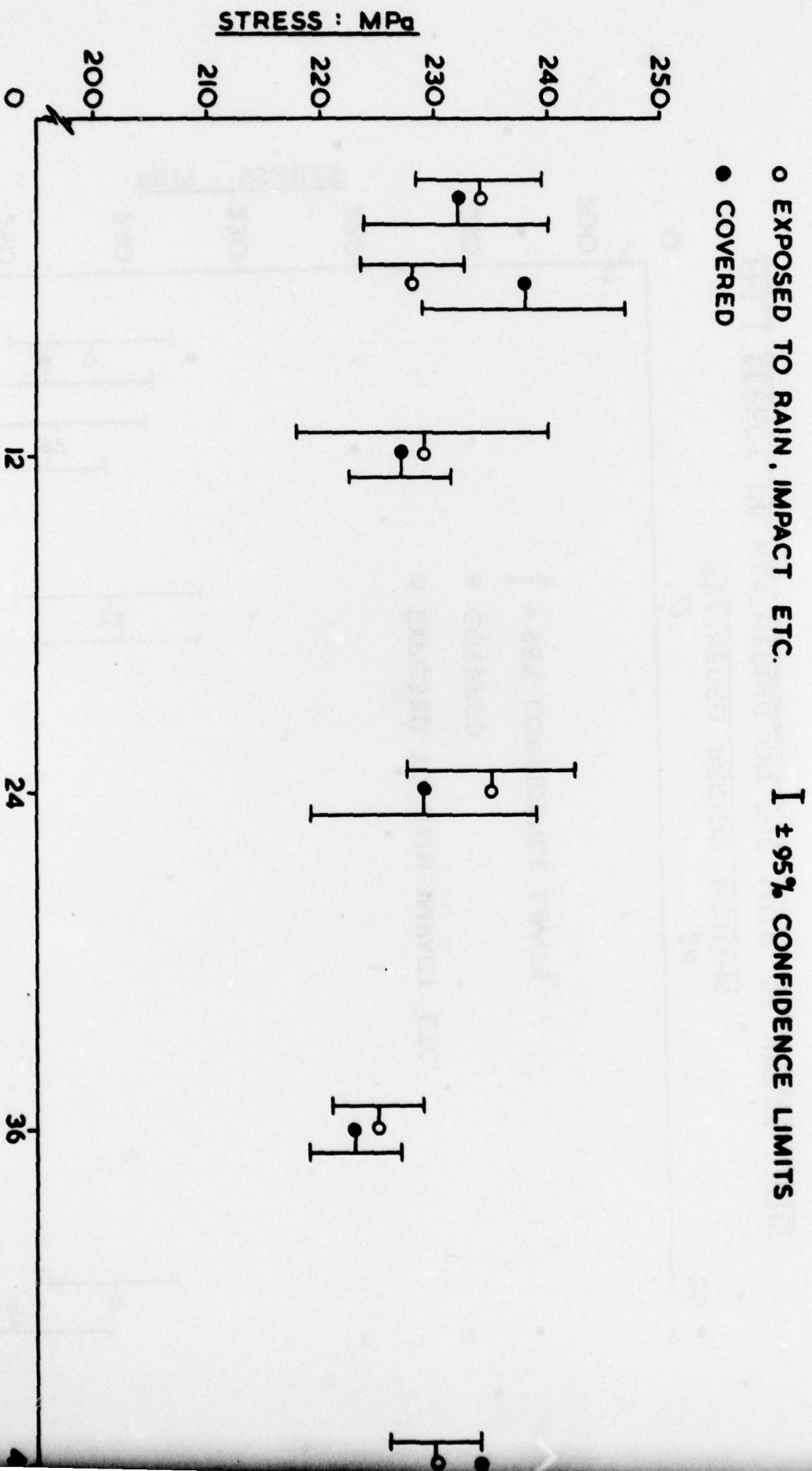


FIG. 2. EFFECT OF WEATHERING ON THE MOR OF VHR 3A LATHS

REPORT DOCUMENTATION PAGE

(Notes on completion overleaf)

Overall security classification of sheet ... **UNCLASSIFIED**

(As far as possible this sheet should contain only unclassified information. If it is necessary to enter classified information, the box concerned must be marked to indicate the classification eg (R),(C) or (S)).

1. DRIC Reference (if known)	2. Originator's Reference DR MAT REPORT 210	3. Agency Reference	4. Report Security Classification UNLIMITED
5. Originator's Code (if known) -	6. Originator (Corporate Author) Name and Location DR MAT, MOD(PE) THE ADELPHI, JOHN ADAM STREET, LONDON WC2N 6BB		
5a. Sponsoring Agency's Code (if known)	6a. Sponsoring Agency (Contract Authority) Name and Location DR MAT, MOD(PE) THE ADELPHI, JOHN ADAM STREET, LONDON WC2N 6BB		
7. Title THE EFFECT OF WEATHERING ON THE MODULUS OF RUPTURE OF VHR2A AND VHR3A GLASSES (GLAVERBEL-MECANIVER SA)			
7a. Title in Foreign Language (in the case of translations) -			
7b. Presented at (for conference papers). Title, place and date of conference -			
8. Author 1. Surname, initials CORNEY N S	9a Author 2 -	9b Authors 3, 4...	10. Date pp ref SEPTEMBER 6 1 1978
11. Contract Number -	12. Period -	13. Project -	14. Other References -
15. Distribution statement UNLIMITED			
Descriptors (or keywords) Mechanical properties; Glass; Aircraft windows; artificial weathering tests.			
Abstract There appears to be no detrimental effect on the modulus of rupture of specimens of VHR2A and VHR3A glasses after they had been exposed either completely or partially for periods up to four years on the roof of the BGIRA building in Sheffield.			

NOTES ON COMPLETION OF REPORT DOCUMENTATION PAGE

This Documentation Page is designed specifically for MOD reports and reports produced by Contractors.

Boxes marked* below need be completed only if the information is readily available.

- *1. DRIC reference: Enter DRIC reference (BR number) if one has been assigned.
2. Originator's Reference: Enter the report number by which the document is identified by the originator of the report, in the form in which it appears on the cover.
3. Agency reference: Enter reference number allocated by sponsoring agency (contract authority) in the case of contract reports.
4. Report Security Classification: Enter security classification or marking which limits the circulation of the report, or enter UNLIMITED when this applies.
- *5. Originator's Code: Code number for the DRIC-standardised form of the entry appearing in Box 6.
- *5a. Sponsoring Agency's Code: Code number for the DRIC-standardised form of the entry appearing in Box 6a.
6. Originator (corporate author): Enter name and location of the organisation preparing the report.
- 6a. Sponsoring Agency (Contract Authority): Enter the name of the monitoring MOD Branch or Establishment in the case of Contractor's reports. If an MOD report covers work funded by an outside agency, enter the name of that agency.
7. Title: Enter the complete report title in capital letters but omitting initial definite or indefinite articles. If the report covers a specific period, enter this after the title, eg (1.1.1972-31.3.1972).
- 7a. Title in Foreign Language: In the case of translations, enter the foreign language title (transliterated if necessary) and the translated English title in Box. 7.
- 7b. Conference Papers: If 7 is the title of a paper presented at a Conference, or a Conference proceedings, enter the Conference Title, where it was held and the date.
8. Author 1: Enter the name of the first author, followed by his initials.
- 9a. Author 2: Enter the name of the second author, followed by his initials.
- 9b. Authors 3,4...: Enter third and following authors' names.
10. Date: Enter the month (in figures) and the year of the report (Dec., 1969 is written 12.1969). If the report is undated but a period covered by the report is indicated, enter the date at the end of the period. pp.ref. Enter the inclusive number of pages in the report containing information, i.e. including appendices, tables and illustrations, and the total number of references cited.
11. Contract Number: Enter the number of the contract or grant under which the report was written.
12. Period: (always associated with the Contract Number). Only to be used for reports covering a specific period, e.g. quarterly, annual or final reports. Enter QR-1, AR, FR, as appropriate.
13. Project: Enter project name or number.
14. Other Reference: Enter any reference, other than those in Boxes 2 or 3, by which the report may be identified.
15. Distribution statement. Enter any limitations on the distribution of the document. If distribution is limited to particular groups eg MOD, MOD and its Contractors, etc. it should be stated. If the distribution is the responsibility of another authority eg a HQ Directorate (Technical Policy Authority) enter "Distribution controlled by MOD Technical Policy Authority". Enter "via DRIC" after "Authority" where appropriate and name the Technical Policy Authority if possible.

Descriptors: Any number of descriptors (or key-words) can be entered. If selected from a published thesaurus, eg The Thesaurus of Engineering and Scientific Terms (TEST), this should be indicated.

Abstract: The abstract should preferably not exceed 150 words, i.e. it can be considerably shorter than the Abstract to be provided on the Title Page of the Report. Information available in the report title need not be included in the abstract.