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GORDON CONFERENCE ON PHYSICAL METALLURGY (1983) 20-24
JUNE 1983 HOLDERNESS SCHOOL NEW HAMPSHIRE (U) RHODE
ISLAND UNIV KINGSTON N E PATON 24 JUN 83

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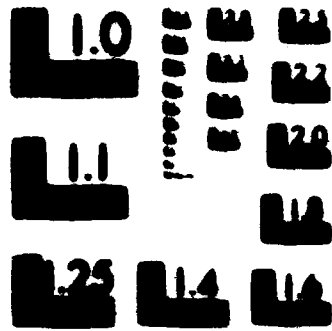
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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM	
1. REPORT NUMBER AFOSR-TR-83-0848		2. GOVT ACCESSION NO.	
3. TITLE AND SUBTITLE BOSTON CONFERENCE ON PHYSICAL METALLURGY 1983		4. TYPE OF REPORT & PERIOD COVERED FINAL REPORT 1982/83-26497	
5. AUTHOR(s) H. E. Paton		6. CONTRACT OR GRANT NUMBER(s) AFOSR-83-0119	
7. AUTHORING ORGANIZATION NAME(S) AND ADDRESS(ES) Gordon Research Conferences University of Rhode Island Kingston, RI 02881		8. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) 61102F 2306/AJ	
9. DISTRIBUTION STATEMENT (see instructions on reverse side) Air Force Office of Scientific Research/AFOSR Building 0410 Ballston AFB, DC 20332		10. REPORT DATE 24 JUN 83	
11. DISTRIBUTION STATEMENT (see instructions on reverse side)		12. NUMBER OF PAGES 8	
13. DISTRIBUTION STATEMENT (see instructions on reverse side)		14. SECURITY CLASS. OF THIS REPORT Unclassified	
15. DISTRIBUTION STATEMENT (see instructions on reverse side)			
16. DISTRIBUTION STATEMENT (see instructions on reverse side)			
17. DISTRIBUTION STATEMENT (see instructions on reverse side)			
18. DISTRIBUTION STATEMENT (see instructions on reverse side)			
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High Temperature deformation, microstructural changes, deformation, alloys.

The topic chosen for the 1983 Gordon Conference on Physical Metallurgy was "High Temperature Deformation" with the emphasis of the presentations being on large strain deformation and microstructure effects. Over one hundred scientists attended the conference, with 21 of them being from outside the United States, mostly from Europe. The quality of the presentations was uniformly excellent, prompting stimulating discussion periods with an extensive exchange of ideas for new approaches and research opportunities.

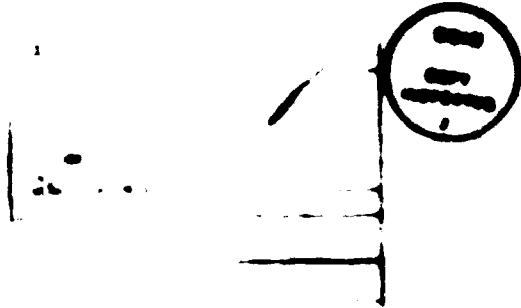
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1983 GORDON CONFERENCE
ON
PHYSICAL METALLURGY

June 20-24, 1983
Holderness School
New Hampshire

FINAL REPORT

Neil Paton
Chairman



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GORDON RESEARCH CONFERENCE

Physical Metallurgy

Malvern School, Plymouth, N. H.

June 20-24, 1963

The topic chosen for the 1963 Gordon Conference on Physical Metallurgy was "High Temperature Deformation" with the emphasis of the presentations being on large strain deformation and microstructure effects.

Over one hundred scientists attended the conference, with 21 of them being from outside the United States, mostly from Europe. The quality of the presentations was uniformly excellent, prompting stimulating discussion periods with an extensive exchange of ideas for new approaches and research opportunities.

The subject of microstructural changes occurring during high temperature deformation was discussed at considerable length during the conference, particularly during the first two days. Formal presentations and detailed discussions led to a clear conclusion that a theory is needed describing nucleation and growth of new grains forming during dynamic recrystallization. The theory is required to understand high temperature deformation processes occurring during hot working and superplastic forming of metals. At present individual researchers are using independent experimental methods to examine these phenomena such as microstructural examination, flow stress measurements, torsion tests, etc., but there is a clear need to tie these methods together in a unified study combined with a satisfactory theoretical model.

Other significant technical issues coming out of the talks and discussions at the conference were a need to better understand flow in multi-phase systems and alloys. This was borne out in talks by Ghosh and Raj on superplasticity, and in the talks by Pharr and Seery on deformation of solid-liquid systems. Problems in understanding powder consolidation are also of a similar nature as discussed by Euser and Arst. Most commercially important alloys are multi-phase, making an understanding of their high temperature deformation of paramount importance.

Other subjects which generated considerable interest and clearly qualify as being candidates for further research in the future were a talk on ordered alloys by C. Liu of Oak Ridge National Laboratory, and acoustic emission phenomena at high temperatures as presented by K. Ono of UCL. A new experimental method of observing deformation in situ at high temperatures also resulted in considerable interest. This method, discussed by C. Hammond of Leeds University, involves the use of an electron emission microscope to observe deformation and phase changes at high temperatures.

Attachments to this report include a copy of the conference program (Attachment "A") and a list of attendees (Attachment "B").

In summary, the conference was well attended and enthusiastically received. The availability of assistance with travel expenses enabled many scientists to take part in the conference who would otherwise have been unable to attend. A total of 12 attendees received some form of financial aid, and although limited funds are made available by the Gordon Research Conferences, the sum is not adequate for the level of support required to ensure a broad ranging and successful conference.

1983 GORDON CONFERENCE ON PHYSICAL METALLURGY
 June 20-24 Noidoross School, Plymouth, N.H.
 TOPIC: HIGH TEMPERATURE DEFORMATION

CONFERENCE CHAIRMAN: Bill Pagan

VICE-CHAIRMAN: Didier Defontaine

Monday, June 20, 1983

SESSION I - MORNING
 MICROSTRUCTURE DEVELOPMENT

Session Chairman:
 E. Ha
 University of Trondheim
 Norway

- 8:30 - 9:30 a.m. THE GENERATION OF MICROSTRUCTURE DURING HIGH TEMPERATURE DEFORMATION:
 R. Kotherly, University of New South Wales, Kensington, NSW, Australia
- 9:30 - 10:30 a.m. A NEW MODEL FOR DYNAMIC RECRYSTALLIZATION
 J. J. Jonas, McGill University, Montreal, Canada and
 T. Sakai, University of Electro-Communications, Tokyo, Japan
- 10:30 - 11:00 a.m. -----BREAK-----
- 11:00 - 11:30 a.m. DYNAMIC RECRYSTALLIZATION OF SINGLE CRYSTALS
 G. Gottstein, University of Aachen, Germany
- 11:30 - 12:00 noon DISCUSSION

SESSION I - EVENING
 MICROSTRUCTURE DEVELOPMENT

Session Chairman:
 J. Hirth, Ohio State University,
 Columbus, Ohio

- 8:00 - 9:00 p.m. THE EVOLUTION OF MICROSTRUCTURE DURING DYNAMIC RECRYSTALLIZATION
 J. Humphreys, Imperial College, London, England
- 9:00 - 10:00 p.m. GRAIN SIZE DISTRIBUTION EFFECTS ON HIGH TEMPERATURE FLOW:
 B. Raj, Cornell University,
 Ithaca, N.Y.

1983 SUMMER CONFERENCE ON PHYSICAL METALLURGY
June 20-24 Wadsworth School, Plymouth, N.H.
TOPIC: HIGH TEMPERATURE DEFORMATION

Tuesday, June 21, 1983

SESSION II - MORNING
HIGH TEMPERATURE FLOW

Session Chairman:
J. Tien
Columbia University
New York, N.Y.

- 8:30 - 9:30 a.m. SOLUTION HARDENING AND STRAIN HARDENING AT ELEVATED TEMPERATURES:
M. Mackay, Technische Universität Hamburg-Harburg, G.
Carmay and P. Neels, Los Alamos Scientific Laboratory
Los Alamos, New Mexico
- 9:30 - 10:30 a.m. MICROSTRUCTURE EVOLUTION AND FLOW LOCALIZATION AT ELEVATED TEMPERATURE:
A. Ghosh, Rockwell International
Thousand Oaks, Ca.
- 10:30 - 11:00 a.m. -----BREAK-----
- 11:00 - 11:30 a.m. FRACTURE IN MULTIAXIAL DEFORMATION
H. Rahn and G. Pitschmann, University of Pittsburgh
Pittsburgh, Pa.
- 11:30 - 12:00 noon DISCUSSION
- 5:00 - 6:00 p.m. POSTER SESSION

SESSION II - EVENING
HIGH TEMPERATURE FLOW

Session Chairman:
S. Mukher
Los Alamos Scientific Laboratory
Los Alamos, New Mexico

- 8:00 - 9:00 p.m. STRUCTURAL BASIS FOR CONSTITUTIVE EQUATIONS:
C. Hartley, Louisiana State University,
Baton Rouge, La.
- 9:00 - 10:00 p.m. MEASUREMENTS OF DYNAMIC CONSTITUTIVE RELATIONS AT HIGH STRAIN RATES:
D. Hooper, SRI
San Jose, Ca.

1963 Gordon Conference on Physical Metallurgy
June 20-24 Walden School, Plymouth, N.H.
TOPIC: HIGH TEMPERATURE DEFORMATION

Wednesday, June 27, 1963

SESSION III - MORNING
HIGH TEMPERATURE FLOW AND FRACTURE

Session Chairman:
G. Baudouin,
Institut National Polytechnique
Saint Martin d'Heres
Grenoble, France

- 8:30 - 9:30 a.m. ENVIRONMENTAL EFFECTS ON HIGH TEMPERATURE DEFORMATION AND BRITTLENESS:
R. Oriani and G. Woodford, General Electric
Albany, New York
- 9:30 - 10:30 a.m. CAVITATION IN HIGH TEMPERATURE DEFORMATION:
A. Argon, MIT
Cambridge, Mass.
- 10:30 - 11:00 a.m. -----BREAK-----
- 11:00 - 11:30 a.m. ENVIRONMENTAL EFFECTS ON CAVITATION:
P. Anderson, and J. Rice, Harvard University
Cambridge, Mass.
- 11:30 - 12:00 noon DISCUSSION
- 6:00 - 6:00 p.m. POWER SESSION

SESSION III - EVENING
HIGH TEMPERATURE FLOW AND FRACTURE

Session Chairman:
P. Gray, U.S. Steel Corporation
Pittsburgh, Pa.

- 8:00 - 9:00 p.m. BRITTLENESS OF STEELS BETWEEN 600-1000°C
H. Suzuki, Nippon Steel
Osaka, Japan
- 9:00 - 10:00 p.m. CHEMISTRY, PROCESSING AND MICROSTRUCTURE EFFECTS IN
HIGH TEMPERATURE FLOW OF STEELS:
L. Cuddy, U. S. Steel Corporation
Pittsburgh, Pa.

1983 GORDON CONFERENCE ON PHYSICAL METALLURGY
June 20-24 Milderness School, Plymouth, N.H.
TOPIC: HIGH TEMPERATURE DEFORMATION

Thursday, June 23, 1983

SESSION IV - MORNING
MULTIPHASE SYSTEMS

Session Chairman:
H. Haas, Stanford University
Stanford, Ca.

- 8:30 - 9:00 a.m. PLAN OF LIQUID-SOLID SYSTEMS:
G. Flory, Rice University
Houston, Texas
- 9:00 - 9:30 a.m. DEFORMATION OF SEMI-SOLID METALLIC SYSTEMS
R. Szary, Institut Nat'l Polytechnique de Grenoble
Grenoble, France
- 9:30 - 9:45 a.m. DISCUSSION
- 9:45 - 10:00 a.m. -----BREAK-----
- 10:00 - 11:00 a.m. SWELLING OF POWDER CONSOLIDATION AT HIGH TEMPERATURES
1. Powder Consolidation under Pressure (Arzt)
2. Powder Consolidation under Capillary Forces (Esnor)
H. Esnor and E. Arzt, Max Planck-Institut für
Metallforschung
Stuttgart, Germany
- 11:00 - 11:15 a.m. DISCUSSION
- 11:15 - 12:00 noon MECHANICAL PROPERTIES OF DUCTILE INTERMETALLIC ALLOYS
C. Liu, Oak Ridge National Laboratory
Oak Ridge, Tenn.

SESSION IV - EVENING

- 8:30 - 9:30 p.m. MODELS FOR THE FORECASTING OF GREAT EARTHQUAKES
Stephen Kirby, US Geological Survey
Reno Park, CA

1983 Gordon Conference on Physical Metallurgy
June 20-24 Waldenwood School, Plymouth, N.H.
TOPIC: HIGH TEMPERATURE DEFORMATION

Friday, June 24, 1983

SESSION V - MEMBERS
HIGH TEMPERATURE FLOW & FRACTURE

Session Chairman:
B. Pagan, Rockwell International
Pittsburgh, PA.

8:30 a.m.

**INFLUENCE OF PARTICLE DISPERSIONS ON RECRYSTALLIZATION
AND GRAIN GROWTH**

E. Eas, University of Trondheim
Norway

**INFLUENCE OF SECOND PHASE PARTICLES ON HIGH TEMPERATURE
DEFORMATION OF ALUMINUM ALLOYS:**

B. Lloyd, AICAM
Kingston, Ontario

**CHARACTERIZATION OF HIGH TEMPERATURE TRANSFORMATIONS AND
DEFORMATION USING ELECTRON BESSION MICROSCOPY**

C. Hammond, Leeds University
Leeds, England

-----BREAK-----

ACOUSTIC EMISSION AT ELEVATED TEMPERATURE

K. Cho, University of California
Los Angeles, Ca.

**ELEVATED TEMPERATURE FATIGUE CRACK GROWTH IN TITANIUM
ALLOYS:**

J. C. Williams, and J. E. Allison, Mellon Institute and
Carnegie Mellon University
Pittsburgh, Pennsylvania

**STRESS STATE INFLUENCES ON CAVITATION DEVELOPMENT IN A
SUPERPLASTIC ALUMINUM ALLOY:**

C. Hamilton, Rockwell International
Riverside Oaks, Ca.

1968 GORDON CONFERENCE ON PHYSICAL METALLURGY
June 29-30 Coldwater School, Plymouth, N.H.
TOPIC: HIGH TEMPERATURE DEFORMATION

POSTER SESSIONS

June 21 - 22, 1968 6-6 P.M.

FLOW IN AN ULTRA-FINE GRAIN NICKEL BASE ALLOY:
J. E. Gregory, Technische Universität Hamburg-Harburg,
U. Conway, and H. D. Isa, Stanford University
Stanford, Ca.

**SMALL-ANGLE X-RAY SCATTERING STUDY OF HIGH
TEMPERATURE DEFORMATION AND FRACTURE:**
H. H. Van, Oak Ridge National Laboratory
Oak Ridge, Tenn.

HIGH TEMPERATURE DEFORMATION OF POLYCRYSTALLINE Mg₂Sn:
E. Wright, Rensselaer Polytechnic Institute
Troy, New York

**THE ROLE OF VARIETIES DURING ELEVATED TEMPERATURE LOW
CYCLE FATIGUE:**
S. J. Gensel, University of Rochester
Rochester, NY

DELEGATION CORE EFFECTS ON YIELDING IN MgAl:
S. P. Papp, University of Pennsylvania
Philadelphia, PA

**TEMPER DEPENDENT AND LENGTH CHANGES DURING HIGH
TEMPERATURE TENSION:**
F. Ruchonnet, CNRS,
France

CRACK GROWTH IN ZrO₂ ALUMINA:
P. Swenson and R.M.S. Pellen, MIT
Cambridge, MA

CRACK GROWTH IN NICKEL-BASE SUPER ALLOYS:
R.M.S. Pellen, and K. Gata, MIT
Cambridge, MA

COMPUTER SIMULATION OF HOT ISOSTATIC PRESSING:
T.B. Deal, Ministry of Defense, Metallurgical Research Lab,
India

Dr-Quinn
Dr-Quinn
Dr-Quinn
Dr-Quinn
Dr-Quinn

GENERAL RESEARCH CONFERENCE

PHYSICAL METALLURGY

Helderness School, Plymouth, MA
June 28-30, 1963

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R-Rathen
U-Webster

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