AD-A232 769

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	January 2, 1991	Final Report 30 Sep 90 to 30 Jun 91

4. TITLE AND SUBTITLE
High Temperature Ordered Intermetallic Alloys

5. FUNDING NUMBERS
AFOSR-90-0367

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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
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8. PERFORMING ORGANIZATION REPORT NUMBER
AFOSR-TR- 91 0132

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Air Force Office of Scientific Research
Dr. Alan Posenstein
AFOSR/NE, Bldng 410
Bolling AFB DC 20332

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
2305/A9

DTIC ELECTE MAR 08 1991 S E D

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

HIGH TEMPERATURE ORDERED INTERMETALLIC ALLOYS

This report summarizes the program and the main themes of a conference of this title held during the Fall Meeting of the Materials Research Society in Boston, Massachusetts, for which the Air Force Office of Scientific Research provided support. The proceedings of this conference will be published in a book by MRS under that title.

14. SUBJECT TERMS	15. NUMBER OF PAGES
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
unclass	unclass	unclass	UL

FINAL REPORT

AFOSR GRANT (AFOSR-90-0367) FOR THE SUPPORT OF THE
1990 MRS CONFERENCE ON:

"HIGH TEMPERATURE ORDERED INTERMETALLIC ALLOYS"

Submitted to

Air Force Office of Scientific Research
Dr. Alan Rosenstein
AFOSR/NE, Bldng 410
Bolling AFB, Washington, D.C. 20332

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Accession For
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QUALITY INSPECTED 3

January, 1991

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INTRODUCTION

The 1990 symposium on "High Temperature Intermetallic Alloys IV" was held as part of the Fall, 1990 MRS meeting in Boston, MA, on November 27 - 30, 1990. The AFOSR supplied a grant to help offset the domestic travel and registration costs of many of the invited speakers and session chairs. Grants totaled $12,000: $5,000 from AFOSR, $5,000 from ORNL, and $2,000 from GE Aircraft Engines.

The attendance at the 3½ day symposium was substantial, averaging approximately 120 attendees per session. A copy of the program of the conference is contained at the end of this report. In this report we give some of the highlights of the meeting.

CONFERENCE DESCRIPTION

This symposium continued the successes of the three previous symposia on this subject held during the MRS Fall Meetings of 1984, 1986 and 1988. A total of 198 papers were presented in the oral and poster sessions to uniformly large audiences.

The subject continues to enjoy the attention of a large number of theorists interested in understanding the tendency for brittleness in intermetallics. Some intermetallics are brittle because of a lack of a sufficient number of slip systems while others have a more than adequate number. Materials of the former type are receiving more attention than the latter from theorists, most of whom are attempting to find ways to decrease specific fault energies and thereby encourage the formation of specific dislocations, e.g. 1/2 <111> dislocation pairs separated by APB in NiAl. To date these theoretical attempts have been unsuccessful, although there are increasing reasons for hope of future successes.

The properties of TiAl-based alloys received a great deal of attention, both from a scientific and from an engineering point of view. The role of interstitials in controlling microstructure and subsequent mechanical properties is becoming recognized as very important, just as in disordered Ti-based and Ti_3Al-based alloys. It was very exciting to learn that a number of TiAl- and Ti_3Al-based alloys are now undergoing testing in aircraft engines.

Unlike previous symposia in which most of the attention was focused on intermetallics with the LI_2 and B2 crystal structures, many presentations were on more exotic structures: DO_{22}, C15, A15, and $C11_b$, for example. Furthermore, great strides have been made in processing techniques as applied to intermetallics, in crystal growth, powder processing, spray forming, and in the production of intermetallic matrix composites. Finally, it is interesting to see that there is increased interest in the environmental resistance of certain intermetallic-based alloys, which is perhaps an indication that intermetallics are being considered for more end uses.

SYMPOSIUM Q

HIGH TEMPERATURE ORDERED INTERMETALLIC ALLOYS

Q

November 27 - 30, 1990

Chairs

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Symposium Support

Air Force Office of Scientific Research

General Electric Aircraft Engines

Martin Marietta Energy Systems, Inc.

**Proceedings published as Volume 213
of the Materials Research Society
Symposium Proceedings Series**

SESSION Q1: ALLOY THEORY AND PHASE STABILITY I

Chairs: A.H. Rosenstein and R.L. Fleischer
Tuesday Morning, November 27
Staffordshire (W)

8:30 A.M. *Q1.1
PHASE STABILITY AND ROLE OF TERNARY ADDITIONS ON ELECTRONIC AND MECHANICAL PROPERTIES, A.J. Freeman, T. Hong, W. Lin and Jian-hua Xu, Northwestern University, Physics and Astronomy Department, Evanston, IL.

9:00 A.M. Q1.2
AB INITIO CALCULATIONS OF STRUCTURAL ENERGETICS OF TRANSITION-METAL ALUMINIDES AND SILICIDES, A.E. Carlsson, Washington University, Department of Physics, St. Louis, MO; and P.J. Meschter, McDonnell Douglas Research Laboratories, St. Louis, MO.

9:15 A.M. Q1.3
APPLICATION OF TIGHT-BINDING HAMILTONIANS TO THE STUDY OF EXTENDED DEFECTS AND DISORDER IN INTERMETALLIC ALLOYS, D.A. Papaconstantopoulos, Naval Research Laboratory, Complex Systems Theory Branch, Washington, DC; E. Kaxiras, Naval Research Laboratory, Complex Systems Theory Branch, Washington, DC and SFA, Inc., Landover, MD; and M.J. Mehl, Naval Research Laboratory, Complex Systems Theory Branch, Washington, DC.

9:30 A.M. Q1.4
CALCULATION OF ELECTRONIC STRUCTURE OF ORDERED AND DISORDERED BINARY (AB) ALLOYS USING THE LMTO PARAMETERS FOR PURE A AND B COMPONENTS, S.K. Bose, Max-Planck-Institut für Festkörperforschung, Stuttgart, West Germany and Brock University, Physics Department, St. Catharines, Canada; J. Kudrnovsky, Max-Planck-Institut für Festkörperforschung, Stuttgart, West Germany and Czechoslovak Academy of Sciences, Institute of Physics, Prague, Czechoslovakia; O. Jepsen and O.K. Andersen, Max-Planck-Institut für Festkörperforschung, Stuttgart, West Germany.

9:45 A.M. Q1.5
ENERGETICS AND STRUCTURAL EFFECTS OF BORON ADDITIVE TO INTERMETALLIC COMPOUND: γ-TiAl, P.K. Khowash, West Virginia University, Department of Physics, Morgantown, WV; D.L. Price, Memphis State University, Department of Physics, Memphis, TN; and B.R. Cooper, West Virginia University, Department of Physics, Morgantown, WV.

10:00 A.M. BREAK

10:30 A.M. Q1.6
THEORETICAL INVESTIGATION OF PHASE STABILITY IN NON-MAGNETIC Fe-V SUBSTITUTIONAL ALLOYS SUBSTITUTIONAL ALLOYS, M. Sluiter and P.E.A. Turchi, Lawrence Livermore National Laboratory, Condensed Matter Division, Livermore, CA.

10:45 A.M. Q1.7
CVM SIMULATION OF THE RESISTIVITY IN $L1_0$ AND $L1_2$ Co-Pt INTERMETALLIC COMPOUNDS, J.M. Sanchez, The University of Texas, Center for Materials Science and Engineering, Austin, TX; M.C. Cadeville, and V. Pierron-Bohnes, IPCMS-GEMME, Strasbourg, France.

11:00 A.M. Q1.8
FREE ENERGY SIMULATIONS OF THE COMPOSITION, STRUCTURE AND THERMODYNAMICS OF GRAIN BOUNDARIES IN ORDERED NI-AL AND CU-AU ALLOYS, R. Najafabaki, H.Y. Wang, D.J. Srolovitz, The University of Michigan, Department of Materials Science and Engineering, Ann Arbor, MI; and R. LeSar, Los Alamos National Laboratory, Los Alamos, NM.

*Invited Paper

Short Course M-10, "An Introduction to High Temperature Ordered Intermetallic Alloys", may be of interest to symposium attendees. See short course section for details.

11:15 A.M. Q1.9
FIRST-PRICIPLE CALCULATIONS OF ANTIPHASE BOUNDARIES AND GRAIN BOUNDARIES IN CLOSE PACKED ORDERED ALLOYS AND ELEMENTAL METALS, Kris M. Hampel, Simon Crampin, and Dimitri D. Vvedensky, Imperial College, The Blackett Laboratory, London, United Kingdom.

11:30 A.M. Q1.10
MEASUREMENT OF BONDING CHARGE DENSITIES IN TITANIUM ALUMINIDES, H.L. Fraser, Ohio State University, Department of Materials Science and Engineering, Columbus, OH; D.M. Maher, North Carolina State University, Department of Materials Science and Engineering, Raleigh, NC; R. Wheeler, Argonne National Laboratory, Argonne, IL; and B. Kad, Ohio State University, Department of Materials Science and Engineering, Columbus, OH.

11:45 A.M. Q1.11
TERNARY ALLOYING OF REFRACTORY INTERMETALLICS, D.L. Anton, United Technologies Research Center, East Hartford, CT; and D.M. Shah, Pratt and Whitney, Department of Materials Engineering, East Hartford, CT.

SESSION Q2: DEFECTS AND MICROSTRUCTURE I

Chairs: H.A. Lipsitt and J.B. Darby
Tuesday Afternoon, November 27
Staffordshire (W)

1:30 P.M. *Q2.1
FROM DISLOCATION CORES TO HIGH TEMPERATURE STRAIN RATE EFFECTS IN $L1_2$ COMPOUNDS, V. Vitek, Y. Sodani and J. Cserti, University of Pennsylvania, Department of Materials Science and Engineering, Philadelphia, PA.

2:00 P.M. *Q2.2
DISLOCATION STRUCTURES AND ANOMALOUS YIELDING IN ORDERED INTERMETALLICS, P.M. Hazzledine, Oak Ridge National Laboratory, Department of Metals and Ceramics, Oak Ridge, TN; and Y.Q. Sun, Oxford University, Department of Materials, Oxford, United Kingdom.

2:30 P.M. Q2.3
COMPARISON OF TEM OBSERVATIONS WITH DISLOCATION CORE STRUCTURE CALCULATIONS IN B2 ORDERED COMPOUNDS, D. Farkas, R. Pasianot and E.J. Savino, Virginia Polytechnic Institute and State University, Department of Materials Engineering, Blacksburg, VA.

2:45 P.M. Q2.4
DISLOCATION CORE STRUCTURES AND MECHANICAL BEHAVIOR OF $L1_2$ AND DO_{22} TYPE Al_3Ti, M. Khantha, V. Vitek and D.P. Pope, University of Pennsylvania, Department of Materials Science and Engineering, Philadelphia, PA.

3:00 P.M. BREAK

3:15 P.M. Q2.5
A MODEL FOR THE YIELD BEHAVIOR OF Ni_3Al ALLOYS, Arnaud de Bussac, Graham Webb and Stephen D. Antolovich, Georgia Institute of Technology, School of Materials Engineering, Atlanta, GA.

3:30 P.M. Q2.6
DISLOCATION NUCLEATION VERSUS CLEAVAGE IN Ni_3Al AND Ni, Yuemin Sun, Lev Truskinovsky, J.R. Rice, and Glenn Beltz, Harvard University, Division of Applied Sciences, Cambridge, MA.

3:45 P.M. Q2.7
STRESS INDUCED MARTENSITIC (SIM) TRANSFORMATIONS IN B2 NiAl OBSERVED IN CRACK PROPAGATION COMPUTER SIMULATIONS, D. Kim, P.C. Clapp and J.A. Rifkin, University of Connecticut, Center for Materials Simulation, Institute of Materials Science, Storrs, CT.

4:00 P.M. Q2.8
ROOM TEMPERATURE DEFORMATION IN "SOFT" ORIENTATION NiAl SINGLE CRYSTALS, R.D. Field, D.F. Lahrman and R. Darolia, GE Aircraft Engines, EMTL, Cincinnati, OH.

4:15 P.M. Q2.9
SLIP TRANSITION IN <001> ORIENTED NiAl AT HIGH TEMPERATURES, J.T. Kim and R. Gibala, The University of Michigan. Department of Materials Science and Engineering, Ann Arbor, MI.

4:30 P.M. Q2.10
BURGERS' VECTOR TRANSITION IN Fe-Ni-Al ALLOYS, D. Keith Patrick, Metcut Research Associates, Cincinnati, OH, and Wright State University, Department of Mechanical and Material Engineering, Dayton, OH; Keh-Minn Chang, GE Corporate Research and Development, Schenectady, NY; Daniel B. Miracle, Air Force Materials Laboratory, Dayton, OH; and Harry Lipsitt, Wright State University, Department of Mechanical and Material Engineering, Dayton, OH.

4:45 P.M. Q2.11
DEFORMATION MICROSTRUCTURES IN B2-TYPE CoTi SINGLE CRYSTALS, M. Yoshida, Miyagi National College of Technology, Miyagi-prefecture, Natori, Japan; and T. Takasugi, Tohoku University, Institute for Materials Research, Sendai, Japan.

SESSION Q3: POSTER SESSION
ALLOY THEORY AND PHASE STABILITY II
Chairs: J.M. Sanchez, V. Vitek, and S.K. Sadananda
Tuesday Evening, November 27
7:30 P.M. - 10:30 P.M.
America Ballroom (W)

Q3.1 INFLUENCE OF MAGNETIC ORDER ON CHEMICAL ORDER IN Fe_xAl_{1-x}. V. Pierron-Bohnes, M.C. Cadeville, Université Louis Pasteur, IPCMS-GEMME, Strasbourg, France; and O. Schaerpf, Institut Laüe Langevin, Grenoble, France.

Q3.2 A COMPARATIVE STUDY OF SHORT RANGE ORDER IN Fe-Cr AND Fe-V ALLOYS AROUND EQUATOMIC COMPOSITION, P.E.A. Turchi, M. Sluiter, Lawrence Livermore National Laboratory, Condensed Matter Division, Livermore, CA; and G.M. Stocks, Oak Ridge National Laboratory, Metals and Ceramics Division, Oak Ridge, TN.

Q3.3 DISORDER-ORDER TRANSITION KINETICS IN L12 TYPE ALLOYS, A.R. Yavari, LTPCM-CNRS, Institut National Polytechnique de Grenoble, St. Martin d'Héres, France; M.D. Baro, Universitat Autonoma de Barcelona, Department de Fisica, Barcelona, Spain; S. Gialanella, University of Cambridge, Department of Materials Science, Cambridge, United Kingdom; P. Desré, M.T. Mora, Universitat Autonoma de Barcelona, Department de Fisica, Barcelona, Spain, and R.W. Cahn, University of Cambridge, Department of Materials Science, Cambridge, United Kingdom.

Q3.4 EFFECT OF APB MICROSEGREGATION ON STRENGTH OF Ni_3Al WITH TERNARY ADDITIONS, *Yuanpang Wu, Columbia University, Henry Krumb School of Mines, New York, NY;* J.M. Sanchez and J.K. Tien, University of Texas, Center for Materials Science and Engineering, Austin, TX.

Q3.5 ELECTRONIC STRUCTURE OF ORDERED AND DISORDERED $Cu_{50}Pd_{50}$ AND Cu_3Pd_3 ALLOYS, S.K. Bose, Max-Planck-Institut für Festkörperforschung, Stuttgart, West Germany and Brock University, Physics Department, St. Catharines, Canada; J. Kudrnovsky, Max-Planck-Institut für Festkörperforschung, Stuttgart, West Germany and Czechoslovak Academy of Sciences, Institute of Physics, Prague, Czechoslovakia; O. Jepsen and O.K. Andersen, Max-Planck-Institut für Festkörperforschung, Stuttgart, West Germany.

Q3.6 THE ROLE OF OFF-DIAGONAL-DISORDER ON ALLOY PHASE STABILITY: AN APPLICATION TO THE NI-PT SYSTEM, M. Sluiter and P.E.A. Turchi, Lawrence Livermore National Laboratory, Condensed Matter Division, Livermore, CA.

Q3.7 LMTO/CVM CALCULATION OF THE NiAl-NiTi PSEUDOBINARY PHASE DIAGRAM, Benjamin Burton, National Institute of Standards and Technology, Metallurgy Department, Gaithersburg, MD; Jean E. Osburn, *Naval Research Laboratory, Complex Systems Theory, Washington, DC;* and Alain Pasturel, CNRS, Metallurgy Department, Grenoble, France.

Q3.8 FIRST-PRINCIPLES CALCULATIONS OF TERNARY PHASE EQUILIBRIA FOR HIGH TEMPERATURE INTERMETALLICS, J.D. Becker, J.M. Sanchez and J.K. Tien, University of Texas, Center for Materials Science and Engineering, Austin, TX.

Q3.9 FIRST PRINCIPLES CALCULATION OF PHASE STABILITY OF HIGH TEMPERATURE INTERMETALLIC ALLOYS, J. Mikalopas, P.A. Sterne, M. Sluiter and P.E.A. Turchi, Lawrence Livermore National Laboratory, Livermore, CA.

Q3.10 EMPIRICAL POTENTIALS FOR TiAl AND NiAl, S. Rao, NRC Fellow, WRDC/MLLM, Wright-Patterson AFB, OH; and C. Woodward, UES, Materials Research Division, Dayton, OH.

Q3.11 ELECTRONIC STRUCTURE AND PHASE STABILITY OF Ni_3V, Co_3V AND Fe_3V, W. Lin, Jian-hua Xu, and A.J. Freeman, Northwestern University, Physics Department, Evanston, IL.

Q3.12 ALLOYING BEHAVIOUR OF Ni_2Si AND THE 900°C ISOTHERMS OF SEVERAL NI-Si-X SYSTEMS AT Ni-RICH CORNER, Zhang Tianxiang, Li Yundong, Zheng Zhi, Zhu Yaoxiao, Institute of Metal Research, Shenyang, China.

Q3.13 ON THE NATURE OF MARTENSITIC PHASE TRANSFORMATIONS IN Ti-Me COMPOUNDS WITH SHAPE MEMORY, S.A. Shabalovskaya, Tomsk University, The V. D. Kuznetsov *Phisico-Technical Institute, Tomsk, USSR.*

Q3.14 PHASE DIAGRAM RELATIONSHIPS IN THE TERNARY SYSTEM Ti-Al-V AT 900°C, Mohan Rao Paruchuri and T.B. Massalski, Carnegie Mellon University, Pittsburgh, PA.

Q3.15 PHASE TRANSFORMATIONS AND MICROSTRUCTURAL DEVELOPMENT IN TIAL-BASED INTERMETALLIC ALLOYS, Peter A. Beaven, GKSS-Research Centre, Geesthacht, West Germany.

Q3.16 MICROSTRUCTURE OF TITANIUM-ALUMINIDE AFTER THERMOMECHANICAL TREATMENT, J. Seeger, C. Hartig, A. Bartels and H. Mecking, Technische Universität Hamburg-Harburg, Physics and Technology of Materials Section, Hamburg, West Germany.

Q3.17 AN INVESTIGATION OF PHASE STABILITY IN THE TERNARY Ta-Ti-Al SYSTEM, Mark L. Weaver, Sandra L. Guy and M.J. Kaufman, University of Florida, Department of Materials Science and Engineering, Gainesville, FL.

Q3.18 THE EFFECT OF OXYGEN ON PHASE TRANSFORMATIONS IN THE ALLOY Ti-25Al-10Nb-3V-1Mo, Angela Szaruga, Mohammad Saqib, *and Harry A. Lipsitt, Wright State University, Department of* Mechanical and Materials Engineering, Dayton, OH.

Q3.19 ON CHARGE DENSITY DETERMINATIONS IN INTERMETALLICS BY CONVERGENT BEAM ELECTRON DIFFRACTION, J.A. Horton and Z.L. Wang, Oak Ridge National Laboratory, Metals and Ceramics Division, Oak Ridge, TN.

Q3.20 STABILIZATION OF NB_3SI BY TERNARY ADDITIONS OF TITANIUM, D.P. Mason, and D.C. Van Aken, The University of Michigan, Department of Materials Science and Engineering, Ann Arbor, MI.

Q3.21 PHASE STABILITY AND SOLIDIFICATION PATHWAYS IN $MoSi_2$ BASED ALLOYS, P.S. Frankwicz and J.H. Perepezko, University of Wisconsin, Department of Materials Science and Engineering, Madison, WI.

Q3.22 METASTABLE PHASE FORMATION IN Be-Nb INTERMETALLIC COMPOUNDS, J.L. Brimhall, L.A. Charlot and S.M. Bruemmer, Pacific Northwest Laboratory, Materials Sciences Department, Richland, WA.

Q3.23 GAMMA-TiAl PHASE BOUNDARIES IN THE Ti-RICH SIDES OF Ti-Al-X (X = V, Cr, Mn, Nb) SYSTEMS, Y-W. Kim, Metcut-Materials Research Group, Wright-Patterson AFB, OH; and D.M. Dimiduk, Wright Research and Development Center, Materials Laboratory, Wright-Patterson AFB, OH.

Q3.24 COMPUTER SIMULATION OF THE ELASTIC ENERGY CONTRIBUTION TO ANTIPHASE BOUNDARY ENERGY ANISOTROPY, Robert G. van der Heide and Samuel M. Allen, Massachusetts Institute of Technology, Department of Materials Science and Engineering, Cambridge, MA.

Q3.25 SHORT-RANGE TO LONG-RANGE ORDERING REACTIONS IN A Ni-25Mo-8Cr ALLOY, Mukul Kumar and Vijay K. Vasudevan, University of Cincinnati, Department of Materials Science and Engineering, Cincinnati, OH.

SESSION Q4: POSTER SESSION
DEFECTS AND MICROSTRUCTURE II
Chairs R.G. Rowe, J.A. Horton, and D. Farkas
Tuesday Evening, November 27
7:30 P.M. - 10:30 P.M.
America Ballroom (W)

Q4.1 A THEORY OF THE POSITIVE TEMPERATURE DEPENDENCE OF YIELD STRESS IN TiAl, T. Kawabata, Sumitomo Light Metal Industries, Ltd., Technical Research Laboratories, Nagoya, Japan; T. Kanai, Hitachi, Ltd., Hitachi Research Laboratory, Hitachi, Japan; and O. Izumi, Tohoku University, Institute for Material Research, Sendai, Japan.

Q4.2 THE EFFECT OF CHEMISTRY ON PLANAR FAULT ENERGIES AND DEFORMATION BEHAVIOR IN SINGLE-PHASE TiAl-BASED ALLOYS, G. Hug, CNRS-ONERA, Laboratoire d'Etudes des Microstructures, Châtillion, France; and D.M. Dimiduk, WRDC Materials Laboratory, Wright-Patterson, AFB, OH.

Q4.3 DEFORMATION OF THE ORTHORHOMBIC PHASE IN Ti-Al-Nb ALLOYS, D. Banerjee, GE Corporate Research and Development, Schenectady, NY and DMRL, Hyderabad, India; R.G. Rowe, and E.L. Hall, Ge Corporate Research and Development, Schenectady, NY.

Q4.4 HIGH TEMPERATURE DEFORMATION AND DISLOCATION STRUCTURE IN SINGLE CRYSTAL $L1_2$ TYPE Ti-Al-V COMPOUND, Y.-D. Hahn, S.H. Whang, Polytechnic University, Metallurgy and Materials Science Department, Brooklyn, NY; and T. Kawabata, Sumitomo Light Metals Industries, Ltd., Nagoya, Japan.

Q4.5 DISLOCATION STRUCTURES IN DEFORMED γ/α_2 TITANIUM ALUMINIDES, W.T. Donlon, W.E. Dowling Jr. and J.E. Allison, Ford Motor Company, Department of Materials Science, Dearborn, MI.

Q4.6 EFFECT OF INTERSTITIAL IMPURITY SOLUTES ON THE DEFORMATION BEHAVIOR IN TITANIUM ALUMINIDES, B. Kad, S. Swaminath and H.L. Fraser, Ohio State University, Department of Materials Science and Engineering, Columbus, OH.

Q4.7 DEFORMATION OF DUCTILITY IN ALLOYS BASED ON Al_3Ti, David G. Morris and Reto Lerf, University of Neuchâtel, Institute of Structural Metallurgy, Neuchâtel, Switzerland.

Q4.8 DISLOCATIONS WITH NON-PLANAR LOCKED STRUCTURES IN THE $L1_2$ ORDERED ALLOYS, Y.Q. Sun, P.M. Hazzledine and M.A. Crimp, University of Oxford, Department of Materials, Oxford, United Kingdom.

Q4.9 EFFECTS OF TEMPERATURE ON THE DISLOCATION SUBSTRUCTURE IN Ni_3Ga SINGLE CRYSTALS, A. Couret, University of Oxford, Department of Materials, Oxford, United Kingdom and CEMES-LOE/CNRS, Toulouse, France; and Y.Q. Sun, University of Oxford, Department of Materials, Oxford, United Kingdom.

Q4.10 THE CRYSTALLOGRAPHY OF CLEAVAGE FRACTURE IN Al_3Sc, J.H. Schneibel, Oak Ridge National Laboratory, Oak Ridge, TN, and Max-Planck-Institut fur Metallforschung, Stuttgart, West Germany; and P.M. Hazzledine, Oak Ridge National Laboratory, Oak Ridge, TN.

Q4.11 HIGH-TEMPERATURE DEFORMATION OF NB-18 AL, T.N. Marieb, S.R. Nutt, Brown University, Engineering Department, Providence, RI; D.L. Anton, United Technologies Research Center, East Hartford, CT; and D.M. Shah, Pratt and Whitney, East Hartford, CT.

Q4.12 COMPUTER SIMULATION OF DEFECTS IN Ni_3Al, T.A. Parthasarathy, C. Woodward, UES, Materials Research Division, Dayton, OH; D. Diller and D.M. Dimiduk, WRDC/MLLM, Materials Laboratory, Wright-Patterson AFB, OH.

Q4.13 A MICROMECHANISM OF ANOMALOUS FLOW IN Ni_3Al, Dongliang Lin and Mao Wen, Shanghai Jiao Tong University, Department of Materials Science and Engineering, Shanghai, China.

Q4.14 MICROMECHANISMS OF DEFORMATION AND FRACTURE IN RAPIDLY SOLIDIFIED Ni_3Al ALLOYS, G.M. Bond, G. Liu and A.S. Akkurt, New Mexico Institute of Mining and Technology, Department of Materials and Metallurgical Engineering, Socorro, NM.

Q4.15 TENSILE AND COMPRESSIVE MICROSTRUCTURES DEVELOPED IN A SUPERALLOY CONTAINING A HIGH VOLUME FRACTION OF THE Ni_3Al ORDERED INTERMETALLIC COMPOUND, J.Y. Buffiere, M. Ignat, LTPCM ENSEEG Domain Universitaire, Saint Martin d'Hères, France; and P. Bastie, Laboratoire de Spectrométrie Physique Université Joseph Fourier Grenoble, Saint Martin, d'Hères, France.

Q4.16 MECHANISM FOR FORMATION OF CONCENTRIC PRISMATIC DISLOCATION LOOPS IN ANNEALED Ni-Al SINGLE CRYSTALS, Yaping Liu, and Samuel M. Allen, Massachusetts Institute of Technology, Center for Materials Science and Engineering, Cambridge, MA.

Q4.17 LONG-RANGE ORDER IN THE ALUMINIDES AND SITE OCCUPATIONS IN THE CUBIC $L1_2(Al_{1-x}M_x)_3Ti$ ALLOYS BY X-RAY DIFFRACTION MEASUREMENTS, C.J. Sparks, R. Kumar, E.D. Specht, P. Zschack, G.E. Ice, J. Schneibel, and C.T. Liu, Oak Ridge National Laboratory, Metals and Ceramics Division, Oak Ridge, TN.

Q4.18 X-RAY DETERMINATION OF SITE OCCUPATION PARAMETERS IN ORDERED TERNARIES $Cu(Au_xM_{1-x})I$,M = Ni,Pd, R. Kumar, C.J. Sparks, Oak Ridge National Laboratory, Metals and Ceramics Division, Oak Ridge, TN; T. Shiraishi, Kyushu University, Japan; E.D. Specht, P. Zschack, G.E. Ice, Oak Ridge National Laboratory, Oak Ridge, TN; and K. Hisatsune, Nagasaki University, Japan.

Q4.19 THE MECHANISMS OF PLASTIC DEFORMATION OF TiAl-BASED ALLOYS CONTAINING VARYING OXYGEN, S. Sriram, Vijay K. Vasudevan, University of Cincinnati, Department of Materials Science and Engineering, Cincinnati, OH; and Dennis M. Dimiduk, Air Force Materials Laboratory, WRDC/MLLM, Wright-Patterson AFB, Dayton, OH.

Q4.20 STRENGTH, FRACTURE AND MICROSTRUCTURAL BEHAVIOR OF B2-PHASE IRON-ALUMINIDES AT 600°, Philip J. Maziasz, Claudette G. McKamey, V.K. Sikka and Camden R. Hubbard, Oak Ridge National Laboratory, Metals and Ceramics Division, Oak Ridge, TN.

Q4.21 ELECTRON MICROSCOPIC OBSERVATION ON THE STRUCTURE OF Ni(Cu)Al MARTENSITE, Seung-Joon Jeon and Hu-Chul Lee, Seoul National University, Department of Metallurgical Engineering, Seoul, Korea.

Q4.22 DEFECT MICROSTRUCTURES AND DEFORMATION MECHANISMS IN THE ORTHORHOMBIC PHASE OF A Ti - 25Al - 20Nb ALLOY, M. Aindow, Ohio State University, Department of Materials Science and Engineering, Columbus, OH; M.J. Kaufman, University of Florida, Department of Materials Science and Engineering, Gainsville, FL; and H.L. Fraser, Ohio State University, Department of Materials Science and Engineering, Columbus, OH.

Q4.23 ELECTRON DIFFRACTION AND HREM IMAGE CHARACTERISTICS OF QUASICRYSTALLINE PHASES IN BINARY, TERNARY AND QUATERNARY ALLOYS, J. Reyes-Gasga, R. Perez,and M. Jose-Yacaman, Instituto UNAM, Mexico, Mexico.

Q4.24 THE EFFECT OF GRAIN BOUNDARY GEOMETRY ON INTERGRANULAR CRACKING IN Ni_3Al, Hui Lin and David P. Pope, University of Pennsylvania, Philadelphia, PA.

Q4.25 COMPUTER SIMULATION STUDY OF GRAIN BOUNDARY STRUCTURE IN B2 NIAL, G. Petton and D. Farkas, Virginia Polytechnic Institute and State University, Department of Materials Engineering, Blacksburg, VA.

Q4.26 A STUDY OF AL DIFFUSIVITY IN THE BCC BETA PHASE OF Nb-Ti-Al SYSTEM, J.G.L. Ruiz Aparicio and F. Ebrahimi, University of Florida, Department of Materials Science and Engineering, Gainesville, FL.

Q4.27 MICROSTRUCTURE OF TITANIUM BERYLLIDE, $TiBe_{12}$, D. Banerjee, D.M.R.L., Hyderbad, India; L. Jacobson, J. Zindel and T. Mitchell, Los Alamos National Laboratory, Los Alamos, NM.

SESSION Q5: DEFECTS AND MICROSTRUCTURE III

Chairs: D.P. Pope and M. Yamaguchi
Wednesday Morning, November 28
Staffordshire (W)

8:30 A.M. *Q5.1
EFFECTS OF ALLOYING ADDITIONS ON INTERGRANULAR FRACTURE OF ORDERED INTERMETALLICS, T. Takasugi, Tohoku University, Institute for Materials Research, Sendai, Japan.

9:00 A.M. Q5.2
THE STRUCTURE AND CHEMISTRY OF GRAIN BOUNDARIES IN Ni_3Al, H. Kung, D.R. Rasmussen and S.L. Sass, Cornell University, Department of Materials Science and Engineering, Ithaca, NY.

9:15 A.M. Q5.3
GRAIN BOUNDARY STRUCTURE AS A FUNCTION OF ALUMINUM LEVEL IN Ni_3Al, J.A. Horton and C.T. Liu, Oak Ridge National Laboratory, Metals and Ceramics Division, Oak Ridge, TN.

9:30 A.M. Q5.4
THE STRUCTURE AND PROPERTIES OF BOUNDARIES IN BICRYSTALS OF Ni_3Al, M.J. Mills, S.H. Goods, Sandia National Laboratories, Materials Department, Livermore, CA; and J.R. Whetstone, General Motors Corporation, Allison Gas Turbine Division, Materials Component Development, Indianapolis, IN.

9:45 A.M. Q5.5
INTERACTION BETWEEN LATTICE DISLOCATIONS AND GRAIN BOUNDARIES IN ORDERED COMPOUNDS: THEORY AND EXPERIMENT, B.J. Pestman, J.Th. M. De Hosson, University of Groningen, Department of Applied Physics, Groningen, Netherlands; V. Vitek, University of Pennsylvania, Department of Materials Science, Philadelphia, PA; and F.W. Schapink, Technical University Delft, Netherlands.

10:00 A.M. BREAK

10:30 A.M. Q5.6
EFFECT OF TERNARY ADDITIONS ON THE STRUCTURE AND DYNAMICS OF α_2/γ INTERFACES IN TiAl, S.R. Singh and J.M. Howe, Carnegie-Mellon University, Department of Metallurgical Engineering and Materials Science, Pittsburgh, PA.

10:45 A.M. Q5.7
ENVIRONMENTAL EMBRITTLEMENT AND GRAIN-BOUNDARY CHEMISTRY OF $MoSi_2$-BASED MATERIALS, E.P. George, and C.T. Liu, Oak Ridge National Laboratory, Metals and Ceramics Division, Oak Ridge, TN.

11:00 A.M. Q5.8
DEFORMATION AND DEFECTS IN C36 LAVES PHASES, J.D. Livingston, Massachusetts Institute of Technology, Department of Materials Science and Engineering, Cambridge, MA; and E.L. Hall, GE Corporation Research and Development, Schenectady, NY.

11:15 A.M. Q5.9
PREPARATION OF NICKEL, TITANIUM, AND NIOBIUM ALUMINIDES BY REACTIVE SINTERING, Arnulf J. Maeland, Concrete Solutions Inc., Meriden, CT; and Dave C. Narasimham, Allied-Signal Inc., Morristown, NJ.

11:30 A.M. Q5.10
THE EFFECT OF STRESS-RELATED DISCONTINUOUS PRECIPITATION ON THE CREEP BEHAVIOR OF Ti_3Al-Nb ALLOYS, R.G. Rowe, M.F.X. Gigliotti and E.L. Hall, GE Corporate Research and Development, Schenectady, NY; and B.J. Marquardt, GE Aircraft Engines, Cincinnati, OH.

11:45 A.M. Q5.11
MICROMECHANISMS OF DEFORMATION AND FRACTURE IN A Ti_3Al-Nb ALLOY, G.M. Bond, A.S. Akkurt and G. Liu, New Mexico Institute of Mining and Technology, Department of Materials and Metallurgical Engineering, Socorro, NM.

SESSION Q6: MECHANICAL PROPERTIES I

Chairs: M.V. Nathal and D. Lin
Wednesday Afternoon, November 28
Staffordshire (W)

1:30 P.M. *Q6.1
TOUGH DUCTILE, HIGH-TEMPERATURE INTERMETALLIC COMPOUNDS: RESULTS OF A FOUR-YEAR SURVEY, R.L. Fleischer, C.L. Briant, General Electric Research and Development Center, Schenectady, NY; and R.D. Field, General Electric Aircraft Engines, Evendale, OH.

2:00 P.M. Q6.2
DEFORMATION PROCESSES AND MECHANICAL PROPERTIES OF BERYLLIUM-NIOBIUM INTERMETALLIC COMPOUNDS, S.M. Bruemmer, L.A. Charlot, L.E. Thomas, C.H. Henager, Jr., Pacific Northwest Laboratory, Richland, WA; R.E. Jacobson and J.P. Hirth, Washington State University, Mechanical and Materials Engineering, Pullman, WA.

2:15 P.M. Q6.3
COMPRESSION BEND AND TENSION STUDIES ON FORGED $Al_6Cr_2Ti_3$ AND $Al_{16}Mn_2Ti_3$ $L1_2$ COMPOUNDS, K.S. Kumar, S.A. Brown, Martin Marietta Laboratories, Baltimore, MD; and J.D. Whittenberger, NASA, Lewis Research Center, Cleveland, OH.

2:30 P.M. Q6.4
MECHANICAL BEHAVIOR OF SINGLE CRYSTALLINE Al-28Ti-6Fe HAVING THE $L1_2$ STRUCTURE, Zili Wu, D.P. Pope and V. Vitek, University of Pennsylvania, Department of Materials Science and Engineering, Philadelphia, PA.

2:45 P.M. Q6.5
(ABSTRACT WITHDRAWN)

2:45 P.M. BREAK

3:15 P.M. *Q6.6
SOLID-SOLUTION HARDENING IN INTERMETALLIC ALLOYS, D.M. Dimiduk, WRDC Materials Laboratory, Wright-Patterson AFB, OH; and S. Rao, WRDC Materials Laboratory, National Research Council, Wright-Patterson AFB, OH.

3:45 P.M. Q6.7
THE EFFECTS OF ALLOY ADDITIONS OF Si AND TRANSITION METAL ELEMENTS ON THE MECHANICAL PROPERTIES OF B DOPED Ni_3Al, Dongliang Lin, and Yun Zhang, Shanghai Jiao Tong University, Department of Materials Science and Engineering, Shanghai, China.

4:00 P.M. Q6.8
FRACTURE AND DEFORMATION STRUCTURE OF Ni_3Al TESTED UNDER HYDROSTATIC PRESSURE, Y.P. Lin, McMaster University, Department of Materials Science and Engineering, Hamilton, Canada; F Zok, University of California, Materials Department, Santa Barbara, Santa Barbara, CA; and J.D. Embury, McMaster University, Department of Materials Science and Engineering, Hamilton, Canada.

4:15 P.M. Q6.9
EFFECT OF ALUMINUM CONCENTRATION AND BORON DOPANT ON ENVIRONMENTAL EMBRITTLEMENT IN FeAl ALUMINIDES, C.T. Liu and E.P. George, Oak Ridge National Laboratory, Metals and Ceramics Division, Oak Ridge, TN.

4:30 P.M. Q6.10
THE GRAIN SIZE DEPENDENCE OF THE ROOM TEMPERATURE STRENGTH AND FRACTURE OF FeAl AND NiAl, I. Baker, F. Liu, P. Nagpal and P.R. Munroe, Dartmouth College, Thayer School of Engineering, Hanover, NH.

4:45 P.M. Q6.11
UNDERSTANDING THE HIGH TEMPERATURE BEHAVIOR OF NIOBIUM ALUMINIDE INTERMETALLICS, A.B. Rodriguez, E.P. Barth, and J.K. Tien, The University of Texas at Austin, Strategic Materials Research and Development Laboratory, Austin, TX.

SESSION Q7: MECHANICAL PROPERTIES II
Chairs: S.H. Whang and R.W. Cahn
Thursday Morning, November 29
Staffordshire (W)

8:30 A.M. *Q7.1
THE ROLE OF TWINNING IN DEFORMATION AND FRACTURE OF Ti-ALUMINIDES, M.H. Yoo, C.L. Fu, Oak Ridge National Laboratory, Metals and Ceramics Division, Oak Ridge, TN; and J.K. Lee, Oak Ridge National Laboratory, Metals and Ceramics Division, Oak Ridge, TN, and Michigan Technological University, Department of Metallurgical and Materials Engineering, Houghton, MI.

9:00 A.M. Q7.2
DUCTILITY AND STRENGTH IN Mo MODIFIED TiAl, T. Maeda, M. Okada, and Y. Shida, Sumitomo Metal Industries, Advanced Technology Research Laboratories, Amagasaki, Japan.

9:15 A.M. Q7.3
FATIGUE BEHAVIOR OF γ/α_2 TITANIUM ALUMINIDES, W.E. Dowling Jr., W.T. Donlon and J.E. Allison, Ford Motor Company, Department of Materials Science, Dearborn, MI.

9:30 A.M. Q7.4
DEFORMATION OF POLYSYNTHETICALLY TWINNED (PST) CRYSTALS OF TiAl IN TENSION AND COMPRESSION AT ROOM TEMPERATURE, H. Inui, A. Nakamura and M. Yamaguchi, Kyoto University, Department of Science and Technology, Kyoto, Japan.

9:45 A.M. Q7.5
CYCLIC DEFORMATION OF B2 ALUMINIDES, S.E. Hartfield-Wünsch and R. Gibala, The University of Michigan, Department of Materials Science and Engineering, Ann Arbor, MI.

10:00 A.M. BREAK

10:30 A.M. Q7.6
DOES A THRESHOLD STRESS FOR CREEP EXIST IN HfC-DISPERSED NiAl? J. Daniel Whittenberger, NASA, Lewis Research Center, Materials Division, Cleveland, OH; Ranjan Ray, Marko Materials Inc., N. Billerica, MA, and Sunil C. Jha, Texas Instruments, Attleboro, MA.

10:45 A.M. Q7.7
FLOW AND FRACTURE BEHAVIOR OF NiAl IN RELATION TO THE BRITTLE-TO-DUCTILE TRANSITION, R.D. Noebe, R.R. Bowman, C.L. Cullers, and S.V. Raj, NASA Lewis Research Center, Materials Division, Cleveland, OH.

11:00 A.M. Q7.8
FRACTURE OF B2 ALUMINIDE SINGLE CRYSTALS, K.-M. Chang, GE Corporate Research and Development, Schenectady, NY; R. Darolia, GE Aircraft Engines, Evendale, OH; and H.A. Lipsitt, Wright State University, Department of Mechanical and Material Engineering, Dayton, OH.

11:15 A.M. Q7.9
THE EFFECT OF STRAIN RATE ON THE MECHANICAL PROPERTIES OF NiAl, D.F. Lahrman, R.D. Field and R. Darolia, GE Aircraft Engines, EMTL, Cincinnati, OH.

11:30 A.M. Q7.10
THE INFLUENCE OF DISLOCATION DENSITY AND DISTRIBUTION ON THE FRACTURE TOUGHNESS OF NIAL, J.M. Brzeski, J.E. Hack, Yale University, Department of Mechanical Engineering, New Haven, CT; and R. Darolia, G.E. Aircraft Engines, Cincinnati, OH.

11:45 A.M. Q7.11
POTENTIAL ROLE OF TEXTURE IN IMPROVED DUCTILITIES OF POLYCRYSTALLINE INTERMETALLIC COMPOUNDS, K. Vedula, Case Western Reserve University, Department of Materials Science and Engineering, Cleveland, OH.

SESSION Q8: ALLOY DESIGN AND PROCESSING I
Chairs: C.T. Liu and H.L. Fraser
Thursday Afternoon, November 29
Staffordshire (W)

1:30 P.M. *Q8.1
POTENTIAL AND APPLICATIONS OF INTERMETALLIC COMPOUNDS FOR ELEVATED TEMPERATURE USE, J.C. Williams and L.A. Johnson, GE Aircraft Engines, Cincinnati, OH

2:00 P.M. *Q8.2
RECENT ADVANCES IN GAMMA TITANIUM ALUMINIDES, Y-W Kim, Metcut-Materials Research Group, Wright-Patterson AFB, OH.

2:30 P.M. Q8.3
TERNARY ALLOYING OF GAMMAS TITANIUM-ALUMINIDE FOR IMPROVED HOT-WORKABILITY, Naoya Masahashi, Youji Mizuhara, Munetsugu Matsuo, Keizo Hashimoto, Masao Kimura, Toshihiro Hanamura and Hideki Fujii, Nippon Steel Corporation, Research and Development Laboratories, Kawasaki, Japan.

2:45 P.M. Q8.4
EFFECT OF INTERSTITIALS ON PHASE STABILITY OF SELECTED INTERMETALLICS, Magdy A. Kassem and Carl C. Koch, North Carolina State University, Department of Materials Science and Engineering, Raleigh, NC.

3:00 P.M. BREAK

3:30 P.M. Q8.5
SPRAY FORMING OF $MoSi_2$ AND $MoSi_2$-BASED COMPOSITES, H. Herman, State University of New York, Department of Materials Science and Engineering, Stony Brook, NY; and S. Sampath, GTE Products Corporation, Chemicals and Metals Division, Towanda, PA.

3:45 P.M. Q8.6
PROCESSING OF THICK-FILM NICKEL-TITANIUM USING VACUUM PLASMA SPRAY DEPOSITION, A. Peter Jardine, Y. Field, and H. Herman, State University of New York at Stony Brook, Department of Materials Science, Stony Brook, NY.

4:00 P.M. Q8.7
A COMPARATIVE STUDY ON THE INFLUENCE OF Nb AND Ti ADDITIONS TO DIFFERENT PROCESSED ATOMIZED NiAl POWDERS, Rainhard Laag, Wolfgang A. Kaysser and Günter Petzow, Max-Planck-Institut für Metallforschung, Pulvermetallurgisches Laboratorium, Stuttgart, West Germany.

4:15 P.M. Q8.8
STRUCTURES AND PROPERTIES OF GAMMA-TiAl ALLOYS CONTAINING INTERSTITIAL ELEMENTS, Shyh-Chin Huang, General Electric Corporate Research and Development, Schenectady, NY.

SESSION Q9: CORROSION I
Chair: J.D. Livingston
Thursday Afternoon, November 29
Staffordshire (W)

4:30 P.M. Q9.1
OXIDATION BEHAVIOR OF GAMMA-TITANIUM ALUMINIDE ALLOYS, Douglas W. McKee and Shyhchin C. Huang, General Electric Corporate Research and Development Center, Schenectady, NY.

4:45 P.M. Q9.2
CHLORIDE-INDUCED LOCALIZED CORROSION OF Fe_3Al - TYPE IRON ALUMINIDES: BENEFICIAL EFFECTS OF Cr AND Mo ADDITIONS, R.A. Buchanan and J.G. Kim, University of Tennessee, Department of Materials Science and Engineering, Knoxville, TN.

SESSION Q10: POSTER SESSION
MECHANICAL PROPERTIES III
Chairs: K. Vedula, E.M. Schulson, J.D. Whittenberger, and S.M. Bruemmer
Thursday Evening, November 29
7:30 P.M. - 10:30 P.M.
America Ballroom (W)

Q10.1 HYDROGEN EMBRITTLEMENT OF ALUMINIDES, M. Shea, A. Castagne and N.S. Stoloff, Rensselaer Polytechnic Institute, Materials Engineering Department, Troy, NY.

Q10.2 EFFECT OF OFFSTOICHIOMETRY ON THE CREEP BEHAVIOR OF BINARY AND TERNARY Ni_3Al, T. Hayashi, Tokyo Institute of Technology, Department of Materials Science and Engineering, Yokohama, Japan; T. Shinoda, Hitachi Ltd, Hitachi Research Laboratory, Hitachi, Japan; Y. Mishima, Tokyo Institute of Technology, Research Laboratory of Precision Machinery and Electronics, Yokohama, Japan; and T. Suzuki, Tokyo Institute of Technology, Department of Metall. Engineering, Tokyo, Japan.

Q10.3 THE COMPRESSION CREEP BEHAVIOR OF Ni_3Al-x SINGLE CRYSTALS, S. Miura, Y. Mishima, Tokyo Institute of Technology, Research Laboratory of Precision Machinery and Electronics, Yokohama, Japan; T. Hayashi, Tokyo Institute of Technology, Department of Materials Science and Engineering, Yokohama, Japan; and T. Suzuki, Tokyo Institute of Technology, Department of Metall. Engineering, Tokyo, Japan.

Q10.4 EFFECTS OF STRESS STATE ON FRACTURE OF ALUMINIDES, J.J. Lewandowski and J. Rigney, Case Western Reserve University, Department of Materials Science and Engineering, Cleveland, OH.

Q10.5 THE STRAIN RATE SENSITIVITY OF $Ni_3(Al,Ta)$ SINGLE CRYSTALS, J. Bonneville and J.L. Martin, Ecole Polytechnique Fédérale de Lausanne, Institut de Genie Atomique, Lausanne, Switzerland.

Q10.6 (ABSTRACT NOT AVAILABLE)

Q10.7 IMPROVEMENT OF ROOM TEMPERATURE DUCTILITY OF Ni_3AL BY UNIDIRECTIONAL SOLIDIFICATION, T. Hirano, National Research Institute for Metals, Chemical Proc. Division, Ibaraki, Japan; S.S. Chung, Y. Mishima, and T. Suzuki, Tokyo Institute of Technology, Research Laboratory of Prec. Mach. and Elec., Yokohama, Japan.

Q10.8 FRACTOGRAPHIC OBSERVATION OF FATIGUE CRACK GROWTH IN CAST Ni_3Al-BASED ALLOYS, Yin Wanquan, Gao Wei, Zhu Yaoxiao, Institute of Metal Research, Academia Sinica, Shenyang, China.

Q10.9 HIGH-TEMPERATURE DUCTILITY OF INTERMETALIC NICKEL ALUMINIDE (IC-218LZr), A. Reza Mirshams, Southern University, Department of Mechanical Engineering, Baton Rouge, LA; Ron H. Baldwin and Vinod K. Sikka, Oak Ridge National Laboratory, Metals and Ceramics Division, Oak Ridge, TN.

Q10.10 EFFECT OF BORON CONTENT ON MECHANICAL PROPERTIES OF MONO-CRYSTALLINE Ni_3Al, Guo Jianting, Sun Chao, Li Hui, Zhang Zhiya, Tang Yajun and Hu Zhuang-Qi, Institute of Metal Research, Department of Superalloy, Academia Sinica, Shenyang, China.

Q10.11 AN INVESTIGATION FOR THE FUNDAMENTAL MECHANISMS OF CYCLIC HARDENING IN Ni_3Al, Graham Webb and Stephen D. Antolovich, Georgia Institute of Technology, School of Materials Engineering, Atlanta, GA.

Q10.12 MICROSTRUCTURE AND MECHANICAL PROPERTIES OF MECHANICALLY ALLOYED NIAI BASE ALLOYS, S.J. Hwang, P. Nash and M. Dollar, Illinois Institute of Technology, Department of Metallurgical and Materials Engineering, Chicago, IL.

Q10.13 THE STRUCTURE/PROPERTY RESPONSE OF Ni_3Al SUBJECTED TO SHOCK WAVE DEFORMATION, G.T. Gray III and H.W. Sizek, Los Alamos National Laboratory, Materials Science and Technology Division, Los Alamos, NM.

Q10.14 FIRST-PRINCIPLES THEORY OF MECHANICAL BEHAVIOR OF B2-TYPE ALUMINIDES, C.L. Fu and M.H. Yoo, Oak Ridge National Laboratory, Metals and Ceramics Division, Oak Ridge, TN.

Q10.15 THE EFFECT OF BORON ON THE MECHANICAL PROPERTIES AND FRACTURE BEHAVIOR OF OFF-STOICHIOMETRIC NiAl, E.P. George, J.J. Laio, and C.T. Liu, Oak Ridge National Laboratory, Metals and Ceramics Division, Oak Ridge, TN.

Q10.16 THE MECHANICAL PROPERTIES OF A Ni-30Al-20Fe-0.05Zr INTERMETALLIC ALLOY IN THE TEMPERATURE RANGE 300-1200 K, S.V. Raj, R.D. Noebe and I.E. Locci, NASA Lewis Research Center, Materials Division, Cleveland, OH.

Q10.17 AGE-HARDENING AND DEFORMATION BEHAVIOR OF NiAl-Fe ALLOYS, J.M. Kostrubanic, Penn State University, Department of Materials Science and Engineering, University Park, PA; I.E. Locci, M.V. Nathal, NASA Lewis Research Center, Cleveland, OH; and D.A. Koss, Penn State University, Department of Materials Science and Engineering, University Park, PA.

Q10.18 STRUCTURE/PROPERTY RELATIONSHIPS IN RAPIDLY SOLIDIFIED AND ANNEALED TERNARY IRON ALUMINIDE ($Fe66.5-Al28.5-Cr5-0.5\ wt\%\ TiB_2$), B. Decamps, CNRS, Universite Paris-Sud, Metallurgie Structurale, Orsay, France; M.A. Gibson, A.J. Morton and A. Wolfenden, CSIRO, Division of Material Science and Technology, Clayton, Australia.

Q10.19 MECHANICAL PROPERTIES OF ORDERED FE-AL-X ALLOYS, U. Prakash, R.A. Buckley and H. Jones, University of Sheffield, School of Materials, Sheffield, United Kingdom.

Q10.20 MECHANICAL PROPERTIES OF Fe-MODIFIED $L1_2$-TYPE Al_3Ti, C.V. Cooper, United Technologies Research Center, East Hartford, CT; H.R. Pak and C.M. Wayman, University of Illinois at Urbana-Champaign, Department of Materials Science and Engineering, Urbana, IL.

Q10.21 ALLOYING OF Al_3Ti WITH Mn AND Cr TO FORM CUBIC $L1_2$ PHASES, J.P. Nic S. Zhang, and D.E. Mikkola, Michigan Technological University, Department of Metallurgical and Materials Engineering, Houghton, MI.

Q10.22 TENSILE AND CREEP BEHAVIOR OF ORDERED ORTHORHOMBIC Ti_2AlNb-BASED ALLOYS, R.G. Rowe, GE Corporate Research and Development, Schenectady, NY; D.G. Konitzer, A.P. Woodfield, and J.C. Chesnutt, GE Aircraft Engines, Cincinnati, OH.

Q10.23 "MICROCRACKING DEVELOPMENT IN THE $L1_2$ TERNARY TITANIUM TRIALUMINIDE", M.B. Winnicka, R.A. Varin, University of Waterloo, Department of Mechanical Engineering, Waterloo, Canada.

Q10.24 ELECTRONIC STRUCTURE OF PLANAR FAULTS IN TiAl, C. Woodward, UES, Materials Research Division, Dayton, OH; J.M. MacLaren, Systran, Materials Science, Dayton, OH; and S. Rao, NRC Fellow, Materials Laboratory, Wright-Patterson AFB, OH.

Q10.25 STRUCTURE DEPENDENCE OF TENSILE CREEP BEHAVIOR IN THERMO-MECHANICALLY-TREATED Ti - 50mol% Al INTERMETALLICS, Tohru Takahashi, Tokyo University of Agriculture and Technology, Division of Mechanical Systems Engineering, Tokyo, Japan; and Hiroshi Oikawa, Tohoku University, Faculty of Engineering, Department of Materials Science, Sendai, Japan.

Q10.26 THE EFFECT OF MICROSTRUCTURE ON THE CREEP PROPERTIES OF TI 24AL-11NB, Diane Albert and Anthony Thompson, Carnegie Mellon University, Pittsburgh, PA.

Q10.27 HIGH TEMPERATURE MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS IN TiAl+Ga ALLOYS, B. Kad, Ohio State University, Department of Materials Science and Engineering, Columbus, OH; B.F. Oliver, University of Tennessee, Department of Materials Science and Engineering, Knoxville, TN; and H.L. Fraser, Ohio State University, Department of Materials Science and Engineering, Columbus, OH.

Q10.28 HIGH TEMPERATURE FLOW BEHAVIOR OF GAMMA-TiAl ALLOYS, D.S. Shih, G.K. Scarr, GE Aircraft Engines, Cincinnati, OH; and D.E. Matejczyk, Rockwell International-Rocketdyne, Canoga Park, CA.

Q10.29 EFFECT OF GRAIN SIZE ON TENSILE PROPERTIES OF A SINGLE PHASE GAMMA TITANIUM ALUMINIDE ALLOY, S Krishnamurthy and Y-W. Kim, Metcut-Materials Research Group, Wright-Patterson AFB, OH.

Q10.30 HIGH TEMPERATURE PROPERTIES OF REFRACTORY INTERMETALLICS, D.M. Shah, Pratt and Whitney, Department of Materials Engineering, East Hartford, CT; and D.L. Anton, United Technologies Research Center, East Hartford, CT.

Q10.31 UNDERSTANDING THE HIGH TEMPERATURE BEHAVIOR OF VERY HIGH MELTING INTERMETALLICS, G.E. Vignoul, J.M. Sanchez and J.K. Tien, University of Texas, Strategic Materials Research and Development Laboratory, Mechanical Engineering Department, Austin, TX.

Q10.32 HIGH TEMPERATURE DEFORMATION OF SINGLE CRYSTALLINE CR_3SI (A15) INTERMETALLIC COMPOUND, C. Steve Chang and David P. Pope, University of Pennsylvania, Department of Materials Science and Engineering Philadelphia, PA.

Q10.33 PRELIMINARY INDICATIONS OF AN IMPROVEMENT IN THE DUCTILITY OF Ni-RICH Ni_3Ge BY BORON MODIFICATION, Jianxing Fang and Erland M. Schulson, Dartmouth College, Thayer School of Engineering, Hanover, NH.

Q10.34 DEFORMATION OF POLYCRYSTALLINE DO_3-TYPE Al_3Ta AT ROOM AND ELEVATED TEMPERATURES. H.R. Pak and C.M. Wayman, University of Illinois, Department of Materials Science and Engineering, Urbana, IL.

Q10.35 MINIATURIZED DISK-BEND TESTING OF Ni_3Al: EFFECT OF STOICHIOMETRY AND BORON CONTENT, Hong Li and Alan J. Ardell, University of California, Los Angeles, Department of Materials Science and Engineering, Los Angeles, CA.

Q10.36 MINIATURIZED DISK-BEND TESTING OF 3.8 MeV Zr^{+} IRRADIATED AND UNIRRADIATED Zr_3Al, Felix Chen, Alan J. Ardell, University of California, Los Angeles, Department of Materials Science and Engineering, Los Angeles, CA; and Dora F. Pedraza, Oak Ridge National Laboratory, Metals and Ceramics Division, Oak Ridge, TN.

Q10.37 MECHANISM OF DUCTILITY IMPROVEMENT IN $L1_2$ COMPOUNDS BY INTERSTITIAL ELEMENTS, T.K. Chaki, State University of New York, Department of Mechanical and Aerospace Engineering, Buffalo, NY.

SESSION Q11: POSTER SESSION
ALLOY DESIGN AND PROCESSING II
Chairs: P.J. Meschter, E.P. George, and D.M. Dimiduk
Thursday Evening, November 29
7:30 P.M. - 10:30 P.M.
America Ballroom (W)

Q11.1 STRUCTURAL MODIFICATION OF INTERMETALLIC COMPOUNDS THROUGH SELECTIVE ALLOYING, I. Baker, Dartmouth College, Thayer School of Engineering, Hanover, NH; and P.R. Munroe, University of New South Wales, School of Materials Science and Engineering, Sydney, Australia.

Q11.2 DEVELOPMENT OF Fe_3Si MATRIX ALLOYS, Zhu Yaoxiao, Lou Lanhong, and Zhan Binda, Institute of Metal Research, Academia Sinica, Shenyang, China.

Q11.3 EFFECT OF Zr ON THE DUCTILITY OF B-FREE POLYCRYSTALLINE Ni_3Al, Zheng Zhi, Wu Weiwen, Zhu Yaoxiao, Institute of Metal Research, Shenyang, China.

Q11.4 EFFECT OF CERAMIC DISPERSOIDS ON THE HIGH TEMPERATURE STRENGTH OF $MoSi_2$, Y.S. Kim, M.R. Johnson, A.B. Gokhale and M.F. Kaufman, University of Florida, Department of Materials Science and Engineering, Gainesville, FL.

Q11.5 SOLID GROWTH VELOCITIES OF Nb-Si PHASES IN UNDERCOOLED MELTS, Gerardo A. Bertero, William H. Hofmeister, Robert J. Bayuzick, Vanderbilt University, Materials Science Department, Nashville, TN; and Michael B. Robinson, Marshall Space Flight Center, Huntsville, AL.

Q11.6 IMPROVEMENTS IN STRENGTH AND DUCTILITY OF FeAl-ZrB_2 BY RAPID SOLIDIFICATION, David G. Morris and Maria A. Morris, University of Neuchâtel, Institute of Structural Metallurgy, Neuchâtel, Switzerland.

Q11.7 SOLIDIFICATION MICROPOROSITY IN EQUIAXED MULTI-COMPONENT NICKEL ALUMINIDE, C.J. Cheng and J.A. Sekhar, University of Cincinnati, Department of Materials Science and Engineering, Cincinnati, OH.

Q11.8 FORMATION OF METASTABLE DISORDERED Ni_3Al BY PULSED LASER-INDUCED RAPID SOLIDIFICATION, Jeffrey A. West and Michael J. Aziz, Harvard University, Division of Applied Sciences, Cambridge, MA.

Q11.9 MICROSTRUCTURE OF RAPIDLY SOLIDIFIED NB_3AL-X RIBBONS, Ken Yasuda, Hideyo Kodama, Tetsuo Fujiwara and Masateru Suwa, Hitachi, Ltd., Hitachi Research Laboratory, Hitachi-shi, Japan.

Q11.10 RECOVERY AND RECRYSTALLIZATION OF ROLLED $(Co,Fe)_3V$ AS A FUNCTION OF THE INITIAL STATE OF THE ALLOY, S Gialanella and R.W. Cahn, Cambridge University, Department of Materials Science and Metallurgy, Cambridge, United Kingdom.

Q11.11 COLD-ROLLING AND SUBSEQUENT ANNEALING OF Ti-RICH TiAl POLYSYNTHETICALLY TWINNED (PST) CRYSTALS, M.H. Oh, H. Inui, S.R. Nishitani and M. Yamaguchi, Kyoto University, Department of Metal Science and Technology, Kyoto, Japan.

Q11.12 DEFORMATION MECHANISMS ASSOCIATED WITH ANNEALED STRUCTURES IN A Ti-24Al-Nb ALLOY, Maria A. Morris and David G. Morris, University of Neuchâtel, Institute of Structural Metallurgy, Neuchâtel, Switzerland.

Q11.13 HEAT TREATMENT STUDY OF SUPER ALPHA-2 (Ti-25Al-10Nb-3V-1Mo) TITANIUM ALUMINIDE SHEETS, Woonsup Park and D.D. Bhatt, Rockwell International - NAA, Downey, CA; and D. Gordon, General Dynamics, Fort Worth, TX.

Q11.14 HOMOGENIZATION OF NEAR-GAMMA TITANIUM ALUMINIDES, W.R. Kerr, M. Stucke, P. McQuay, WRDC, Materials Laboratory, Wright-Patterson AFB, OH; and S.L. Semiatin, Battelle's Columbus Laboratories, Metal Working Department, Columbus, OH.

Q11.15 A STUDY ON THE ROLLING TEXTURE AND ITS RELATED ANISOTROPIC PROPERTIES OF A $Ti_3Al_2Nb_{10}$ ALLOY, W.P. Hon, S.K. Wu, and D.H. Koo, National Taiwan University, Graduate Institute of Materials Engineering, Taipei, Taiwan, Republic of China.

Q11.16 HOT EXTRUSION OF A Ti-Al-Nb-Mn ALLOY, V. Seetharaman, UES, Incorporated, Processing Science Division, Dayton, OH; and J.C. Malas, WRDC/MLLM, Wright-Patterson AFB, OH.

Q11.17 TENSILE DEFORMATION AND FRACTURE BEHAVIOR OF A Ti-Al-Nb-Mn ALLOY UNDER HOT WORKING CONDITIONS, V. Seetharaman, UES, Incorporated, Processing Science Division, Dayton, OH; S.I. Oh and S.L. Semiatin, Battelle's Columbus Laboratories, Metal Working Department, Columbus, OH.

Q11.18 POWDER PROCESSING OF Fe_3Al-BASED IRON-ALUMINIDE ALLOYS, Vinod K. Sikka, Oak Ridge National Laboratory, Metals and Ceramics, Oak Ridge, TN; John H. Reinshagen, Ametek, Eighty Four, PA; Jill Knobe and Richard N. Wright, EG&G Idaho, Idaho Falls, ID.

Q11.19 PRODUCTION OF Fe_3Al-BASED INTERMETALLIC ALLOYS, Vinod K. Sikka, Oak Ridge National Laboratory, Metals and Ceramics, Oak Ridge, TN.

Q11.20 FABRICATION OF DENSE NICKEL ALUMINIDE MONOLITHIC AND COMPOSITE BODIES BY COMBINED SELF PROPAGATING HIGH TEMPERATURE SYNTHESIS (SHS) AND IN SITU CONTAINERLESS HOT ISOSTATIC PRESSING (HIP), Michael Concannon, Edwin S. Hodge, Andrew C. Nyce and Christopher P. Turmel, Gorham Advanced Materials Institute, Gorham, ME.

Q11.21 CRACKING IN THE WELD HEAT-AFFECTED ZONE OF CONTINUOUSLY CAST SHEET AND INGOT ON Ni_3Al, Huaxin Li and T.K. Chaki, State University of New York, Buffalo, Department of Mechanical and Aerospace Engineering, Buffalo, NY.

Q11.22 FABRICATION OF Ni-Al THIN FILMS BY PULSED LASER EVAPORATION TECHNIQUE, Deepika Bhattacharya, North Carolina State University, Department of Materials Science and Engineering, Raleigh, NC; R.K. Singh, University of Florida, Department of Materials Science and Engineering, Gainesville, FL; S. Sharan and J. Naraayan, North Carolina State University, Department of Materials Science and Engineering, Raleigh, NC.

Q11.23 PHASE FORMATION, PHASE STABILITY, AND GRAIN-SIZE CONTROL IN THE Al-Ti THIN FILM SYSTEM, L.R. Parks, P. Borgesen, Cornell University, Department of Materials Science and Engineering, Ithaca, NY; D.A. Lilienfeld, Cornell University, National Nanofabrication Facility, Ithaca, NY; and R. Raj, Cornell University, Department of Materials Science and Engineering, Ithaca, NY.

Q11.24 THE EFFECTS OF DIRECTIONAL SOLIDIFICATION PROCESSING ON THE MICROSTRUCTURE OF NICKEL ALUMINIDES, H. Kim, J.C. Earthman and E.J. Lavernia, University of California, Irvine, Materials Section, Department of Mechanical Engineering, Irvine, CA.

SESSION Q12: POSTER SESSION
CORROSION II
Chair: J.D. Livingston
Thursday Evening, November 29
7:30 P.M. - 10:30 P.M.
America Ballroom (W)

Q12.1 OXIDATION OF Ni_3Al SINGLE CRYSTALS AT DIFFERENT PRESSURES AND TEMPERATURES, E. Schumann, U. Salzberger and M. Rühle, Max-Planck-Institut für Metallkunde, Institut für Werkstoffwissenschaft, Stuttgart, West Germany

Q12.2 OXIDATION BEHAVIOR OF Ni ALUMINIDES USING X-RAY ABSORPTION SPECTROSCOPY, R.B. Greegor and F.W. Lytle, The Boeing Company, Seattle, WA.

Q12.3 HIGH TEMPERATURE CORROSION OF INTERMETALLIC PHASES BASED ON Ni_3Al, U. Brill and J. Klöwer, VDM-Nickel-Technologie, Werdohl, Germany.

Q12.4 OXIDATION BEHAVIOR OF ADVANCED INTERMETALLIC MATERIALS, Douglas W. McKee and Robert L. Fleischer, General Electric Corporate Research and Development Center, Schenectady, NY.

Q12.5 DEVELOPMENT OF SURFACE TREATMENT TECHNIQUES TO IMPROVE IN OXIDATION RESISTANCE OF TITANIUM ALUMINIDE, Michiko Yoshihara, Ryohei Tanaka, Tetsuya Suzuki, Masayuki Shimizu, Yokohama National University, Department of Mechanical Engineering and Materials Science, Yokohama, Japan.

Q12.6 AN XPS STUDY OF THE PASSIVE FILM FORMED ON $MoSi_2$ IN HCl AQUEOUS SOLUTIONS, G. Halada, C.R. Clayton and A. Peter Jardine, State University of New York at Stony Brook, Department of Materials Science, Stony Brook, NY.

SESSION Q13: POSTER SESSION
MULTIPHASE MATERIALS AND COMPOSITES I
Chair: V.K. Sikka
Thursday Evening, November 29
7:30 P.M. - 10:30 P.M.
America Ballroom (W)

Q13.1 MECHANICAL PROPERTIES OF NEAR EUTECTIC β-NiAl AND α-Re ALLOYS PRODUCED BY RAPID SOLIDIFICATION AND EXTRUSION, D.C. Van Aken, D.P. Mason, The University of Michigan, Department of Materials Science and Engineering, Ann Arbor, MI; R.D. Noebe, I.E. Locci and K.L. King, NASA Lewis Research Center, Cleveland, OH.

Q13.2 COMPRESSION STUDIES ON PARTICULATE COMPOSITES OF QUATERNARY Al-Ti-Fe-Nb AND Al-Ti-Fe-Mn $L1_2$ COMPOUNDS, K.S. Kumar, M.S. DiPietro, Martin Marietta Laboratories, Baltimore, MD; and J.D. Whittenberger, NASA, Lewis Research Center, Cleveland, OH.

Q13.3 THE EVOLUTION OF A TWO-PHASE GAMMA + SIGMA MICROSTRUCTURE FROM THE BETA PHASE IN THE TERNARY Nb-Ti-Al SYSTEM, D.T. Hoelzer and F. Ebrahimi, University of Florida, Department of Materials Science and Engineering, Gainesville, FL.

Q13.4 THE FORMATION OF NiAl PHASE DURING Ni_3Al/SiC SOLID STATE REACTIONS, T.C. Chou and T.G. Nieh, Lockheed Missiles and Space Company, Research and Development Division, Palo Alto, CA.

Q13.5 MICROSTRUCTURE AND MECHANICAL PROPERTIES OF Ni_3Al-BASED ALLOYS REINFORCED WITH PARTICULATES, C.G. McKamey and C.A. Carmichael, Oak Ridge National Laboratory, Metals and Ceramics Division, Oak Ridge, TN.

Q13.6 PHASES AND MICROSTRUCTURE MORPHOLOGIES IN COMBUSTION SYNTHESIZED NB-AL-B COMPOSITES MATERIALS, C.T. Ho and J.A. Sekhar, University of Cincinnati, Department of Materials Science and Engineering, Cincinnati, OH.

Q13.7 AN AEM STUDY OF THE NB-10a/oSI INTERMETALLIC ALLOY, A.G. Jackson and M. Mendiratta, UES, Incorporated, Dayton, OH.

Q13.8 THE DISLOCATION STRUCTURE AND DEFORMATION MECHANISM OF TiB_2 NiAl COMPOSITES, L. Wang, University of Maryland, Metallurgical Materials Laboratory, College Park, MD.

Q13.9 ORIGINS OF TOUGHENING IN A DUAL-PHASE NB-AL ALLOY, A.D. Kaiser, T.N. Marieb and S.R. Nutt, Brown University, Department of Engineering, Providence, RI; D.L. Anton, United Technologies Research Center, East Hartford, CT; and D.M. Shah, Pratt and Whitney, E. Hartford, CT.

SESSION Q14: MULTIPHASE MATERIALS AND COMPOSITES II
Chairs: D.G. Morris and K.S. Kumar
Friday Morning, November 30
Staffordshire (W)

8:30 A.M. *Q14.1
PROCESSING AND PROPERTIES OF INTERMETALLIC MATRIX COMPOSITES, Norman S. Stoloff, Rensselaer Polytechnic Institute, Materials Engineering Department, Troy, NY.

9:00 A.M. Q14.2
LOADING RATE EFFECTS ON DUCTILE-PHASE TOUGHENING IN IN-SITU NIOBIUM SILICIDE-NIOBIUM COMPOSITES, Joseph D. Rigney, Case Western Reserve University, Materials Science, Cleveland, OH; M.G. Mendiratta, UES, Materials Research Division, Dayton, OH; Larry Matson and Dennis M. Dimiduk, WRDC/MLLM, Wright-Patterson AFB, OH.

9:15 A.M. Q14.3
TOUGHNESS AND CRACK GROWTH RESISTANCE OF NIOBIUM-NIOBIUM SILICIDE POWDER COMPOSITES, Rama M. Nekkanti, Jyothi Menon, and Dennis M. Dimiduk, Wright Research and Development Center, Wright Patterson AFB, OH.

9:30 A.M. Q14.4
MICROSTRUCTURE AND PROPERTIES OF EUTECTIC COMPOSITES BASED ON $(Ti, Nb)_3(Al, Si)$ AND $(Ti, Nb)_5(Si, Al)_3$, R. Wagner, D. Chen, B. Dogan, M. Es-Souni, Peter A. Beaven, GKSS-Research Centre, Hamburg, West Germany.

9:45 A.M. Q14.5
MICROSTRUCTURE AND MECHANICAL PROPERTIES OF A SINGLE CRYSTAL NiAl ALLOY WITH Zr, Si, RICH PRECIPITATES, Ivan E. Locci, Ronald D. Noebe, Randy R. Bowman, NASA-Lewis Research Center, Materials Division, Cleveland, OH; and Ram Darolia, GE Aircraft Engines, Materials Department, Cincinnati, OH.

10:00 A.M. BREAK

10:30 A.M. Q14.6
CREEP DEFORMATION OF DISPERSION STRENGTHENED NiAl AND TiAl INTERMETALLICS, K. Sadananda, H. Jones, J. Feng and A.K. Vasudevan, Naval Research Laboratory, Materials Science and Technology Division, Washington, DC.

11:00 A.M. Q14.8
OXIDATION KINETICS OF $MoSi_2$ AND $MoSi_2$/REINFORCEMENT MIXTURES, P.J. Meschter, McDonnell Douglas Research Laboratories, St. Louis, MO.

11:15 A.M. Q14.9
PROCESSING OF CONTINUOUS OXIDE FIBER REINFORCED INTERMETALLIC COMPOSITES BY PRESSURE CASTING, Said Nourbakhsh, and Harold Margolin, Polytechnic University, Department of Metallurgy and Materials Science, Brooklyn, NY.

11:30 A.M. Q14.10
COMPUTER SIMULATION OF STRAIN-INDUCED MORPHOLOGY CHANGES DURING DECOMPOSITION AND COARSENING, Yunzhi Wang, Long-Qing Chen and A. Khachaturyan, Rutgers University, Department of Mechanical and Materials Science, Piscataway, NJ.

11:45 A.M. Q14.11
SOURCES OF CREEP RESISTANCE IN CMSX-3 SINGLE CRYSTALS, Ali S. Argon and Frederick G. Haubensak, Massachusetts Institute of Technology, Department of Mechanical Engineering, Cambridge, MA; Tresa M. Pollock, General Electric Company, Aircraft Division, Cincinnati, OH.