

Program

SUPERALLOYS

September 12 - 16, 2010
Awaji Island, Japan

Program Chairs:

Professor **Sammy Tin**,
Illinois Institute of Technology, USA

Professor **Qiang (Charles) Feng**
University of Science and Technology Beijing (USTB), China

Professor **Roger Reed**
The University of Birmingham, UK

Professor **Tresa M. Pollock**
University of California at Santa Barbara, USA

Dr. **Hideyuki Murakami**
National Institute for Materials Science, Japan

Professor **Koji Kakehi**
Tokyo Metropolitan University, Japan



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Sunday, September 12, 2010

16:00 – 18:00	Registration (Reception Hall B Foyer, Conference Center)
18:00 – 20:00	Welcome Reception and Dinner (Reception Hall B Foyer)
20:00 – 20:15	Welcome and Announcements (Reception Hall B)
20:15 – 21:15	Plenary Keynote Talk: AERO-ENGINE BUSINESS AND MATERIALS TECHNOLOGIES IN JAPAN, NOW AND CHALLENGES, Yukiya Nakagawa, IHI

NOTES

- Technical Sessions will be held in Reception Hall B in the Conference Center.
- Vouchers will be distributed at registration for lunches (Mon, Tues, and Wed.) and for dinners on Monday and Tuesday.
- Breakfasts will be in the Westin Hotel.
- Audiotaping, videotaping and photography of presentations are prohibited.
- Speakers – Please leave at least 5 minutes for questions and discussion.
- Please do not smoke at any conference functions.
- Turn your cellular telephones to vibrate or off during technical sessions.
- Be sure to make any corrections to your name/contact information on the Master Participant List or confirm that the listing is correct. A corrected copy will be sent to all participants after the conference.

Monday, September 13, 2010

07:00 – 08:00 Breakfast

Session 1: Alloy Deployment

- 08:30 – 09:10 Alloys by design: application to single crystal superalloys
Roger C Reed, University of Birmingham, UK (Invited)
- 09:10 – 09:50 Single-crystal superalloy design approach for industrial gas turbine application
Akane Suzuki, GE Global Research, USA (Invited)
- 09:50 – 10:20 Effect of ruthenium on microstructure and properties of high Re bearing single crystal superalloys
Yushi Luo, Beijing Institute of Aeronautical Materials, China
- 10:20 – 10:40 Coffee break
- 10:40 – 11:20 Development of a W and Re reduced single crystal alloy (LEK 94) with reduced density and price
Uwe Glatzel, Metals and Alloys, University of Bayreuth, Germany (Invited)
- 11:20 – 11:50 Effects of Ru and Cr on microstructure and stress-rupture property of Ni-based single crystal superalloys
J.Y. Chen, State Key Laboratory for Advanced Metals and Materials, University of Science and Technology Beijing, China
- 11:50 – 12:20 Effects of chromium and ruthenium on the microstructures and creep rupture life for a single crystal nickel-base superalloy
Tao Jin, Institute of Metal Research, Chinese Academy of Sciences, China
- 12:20 – 14:00 Lunch
- 14:00 – 14:40 Microstructure and properties of new gamma prime strengthened Co-base alloys
Tresa M. Pollock, University of California Santa Barbara, USA (Invited)
- 14:40 – 15:10 Development of dual two-phase intermetallic alloys composed of geometrically close packed Ni₃Al and Ni₃V structures
Takayuki Takasugi, Osaka Prefecture University, Japan (Invited)
- 15:10 – 15:40 Polycrystalline γ - γ' - δ Ternary Eutectic Ni-Base Superalloys
Sammy Tin, IIT, USA
- 15:50 – 16:10 Coffee Break

Session 2: Mechanical Behavior

- 16:10 – 16:40 Creep mechanisms of Ni-Co-base disc superalloys
Y. Yuan, National Institute for Materials Science, Japan
- 16:50 – 17:20 Fatigue crack propagation in the post-service gas turbine superalloy by miniature ct specimen
Motoki Sakaguchi, Nagaoka University of Technology, Japan

Monday, September 13, 2010 (continued)

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| 17:20 – 17:50 | Influence of refinement in dendritic structure on the fatigue crack growth behavior in single-crystal nickel-base superalloys
Clinique L. Brundidge, University of Michigan, USA |
| 19:00 – 20:30 | Dinner |
| 20:30 – 22:00 | Poster Session I and Social Hour |

Tuesday, September 14, 2010

07:00 – 08:00	Breakfast
08:00 – 08:15	Announcements
08:30 – 09:10	Determining fault energies in the γ' phase of Ni-based superalloys Catherine Rae, Materials Science and Materials, Cambridge University, UK (Invited)
09:10 – 09:40	The effects of composition and heat treatment on fatigue crack propagation performance of various sub-solvus and super-solvus heat treated turbine disc alloys S. Everitt, Materials Research Group, University of Southampton , UK
09:40 – 10:10	On the effect of creep on local lattice orientation in single crystal Ni-based superalloy microstructures E. J. Payton, Institute for Materials, Ruhr-Universität Bochum, Germany
10:10 – 10:30	Coffee break
10:30 – 11:10	High temperature biaxial fatigue property of polycrystalline and directionally solidified Ni base superalloys Takashi Ogata, CRIEPI, Japan (Invited)
11:10 – 11:40	The influence of the gamma/gamma prime microstructure evolutions on the very high temperature/low stress non-isothermal creep behaviour of 4th generation single crystal nickel-based superalloy Xavier Milhet, PPRIME UPR CNRS 3346, France
11:40 – 12:10	New Results on Creep Testing of Ni-Based Superalloys with Miniaturized Specimens P. Nörtershäuser, Institut für Werkstoffe, Ruhr-Universität Bochum, Germany
12:10 – 14:00	Lunch
14:00 – 14:30	Three-Dimensional characterization of dislocation networks in lightweight single crystal Ni-based superalloy microstructures L. Agudo, Institut für Werkstoffe, Ruhr University Bochum, Germany
14:30 – 15:00	Constitutive modelling of the creep behavior of single crystal superalloys under non-isothermal conditions inducing phase transformations Julien Ghighi, Turbomeca - SAFRAN group / Institut P' - CNRS – ENSMA – Université de Poitiers, UPR CNRS 3346, France
15:10 – 15:40	Destabilization of the rafted structure during creep in Ni-based superalloys simulated by phase-field method Yuhki Tsukada, Graduate School of Engineering, Nagoya University
15:40 – 16:00	Coffee break

Tuesday, September 14, 2010 (continued)

Session 3: Physical Metallurgy

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| 16:00 – 16:40 | Rafting caused by prestraining and subsequent annealing in a Ni superalloy
Tsutomu Mori, Materials Science Centre, University of Manchester, UK/ Japan (Invited) |
| 16:40 – 17:10 | Serrated grain boundary formation and its implications in a wrought Ni-based superalloy with low gamma-prime volume fraction
Hyun Uk Hong, Korea Institute of Materials Science, Korea |
| 17:10 – 17:40 | The effect of γ' dissolution and TCP phase formation on lattice misfit
Steffen Neumeier, University of Cambridge, Department of Materials Science & Metallurgy, UK |
| 19:00 – 20:30 | Dinner |
| 20:30 – 22:00 | Poster Session and Social Hour |

Wednesday, September 15, 2010

07:00 – 08:00 Breakfast

Session 4: Honorary session on solidification for Professor Hu from IMR

08:20 – 08:30 Opening remarks from Prof. Qiang Feng, University of Science and Technology, Beijing, China

08:30 – 09:00 Directionally solidified IGT blade by liquid metal cooling process
J. Zhang, Institute of Metal Research, Chinese Academy of Sciences, China (Invited)

09:00 – 09:30 Effect of refractory and trace elements on the solidification characteristics and segregation of single crystal superalloys under high thermal gradient directional solidification
Lin Liu, Northwestern Polytechnical University, China (Invited)

09:30 – 10:00 Determining heat transfer coefficients during precision casting of superalloys
Rainer Völkl, Metals and Alloys, University of Bayreuth, Germany

10:00 – 10:20 Coffee Break

10:20 – 10:50 Investigation on the quality control factor of castings with high Cr content cast Ni-base superalloy K4648
Liang Zheng, National Key Laboratory of Science and Technology on Advanced High Temperature Structural Materials, Beijing Institute of Aeronautical Materials, China (Invited)

10:50 – 11:20 Melt superheating treatment: influence on solidification microstructure and mechanical property of Ni-based monocrystal superalloy
Lin Liu, State Key Laboratory of Solidification Processing, Northwestern Polytechnical University, China

11:20 – 11:50 Formation of stray grains during directional solidification of nickel-based superalloys
Yizhou Zhou, Institute of Metal Research, Chinese Academy of Sciences, China

11:50 – 12:30 Research Activities of Solidification on Development of Superalloys
Prof. Hu, Institute of Metal Research, Chinese Academy of Sciences, China (invited)

12:30 – 12:35 Closing Remarks

12:35 – 14:00 Lunch

Session 5: Interfaces and Coatings

14:00 – 14:40 Characterization of a hip-bonding between a PM Disk superalloy and a single crystal blade superalloy
Pierre Caron, ONERA, France (Invited)

14:40 – 15:20 Oxidation and inter-diffusion behaviors of rutil coated single crystal superalloy
Hongbo Guo, Beijing University of Aeronautics and Astronautics, China

Wednesday, September 15, 2010 (continued)

15:20 – 15:50	Comparison of EQ and MCRALY bond coats for thermal barrier applications Christopher Mercer, National Institute for Materials Science, Japan
15:50 – 16:20	3D study of microstructural evolution in coated nickel-based superalloys S.D. Newman, Loughborough University, UK
16:20 – 16:40	Coffee Break
16:40 – 17:20	Microstructural changes of bond-coated Ni-based single crystal superalloys, effect of pre-surface treatment, surface crystal orientation and coating process Hideyuki Murakami, National Institute for Materials Science, Japan (Invited)
17:20 – 17:50	Modeling of microstructural evolution in multi-layered overlay coatings M.S.A. Karunaratne, Loughborough University, UK
17:50 – 18:20	Effect of heat treatment on fracture behavior and delamination toughness in air plasma-sprayed Y_2O_3 - ZrO_2 thermal barrier coating system Makoto Hasegawa, Division of Materials Science and Engineering, Graduate School of Engineering, Yokohama National University, Japan
19:30 – 22:00	Banquet and talk by Ram Darolia (Westin Hotel)

Thursday, September 16, 2010

07:00 – 08:00	Breakfast
08:30	Bus departure for Optional Industry Tour

Poster List

- CONTRIBUTIONS OF GRAIN BOUNDARY SLIDING AND INTRAGRANULAR PLASTICITY TO THE CREEP BEHAVIOUR OF A DISK SUPERALLOY**
Didier LOCQ, Office National d'Études et de Recherches Aérospatiales (ONERA), FRANCE
- INFLUENCE OF THE DENDRITIC/INTERDENDRITIC CHEMICAL COMPOSITION ON THE MECHANICAL PROPERTIES OF A 4TH GENERATION SUPERALLOY STUDIED BY NANOHARDNESS CARTOGRAPHY**
Xavier Milhet, PPRIME UPR CNRS, France
- DEFLECTED 'TEAR DROP' CRACKING IN NICKEL BASED SUPERALLOYS**
Christian Schoettle, School of Engineering Sciences, University of Southampton, UK
- THE DEGRADATION BEHAVIOR OF THERMAL BARRIER COATINGS ON A 4TH GENERATION SINGLE CRYSTAL SUPERALLOY TMS-138**
Akira Tateno, IHI Corporation, Japan
- MICROSTRUCTURAL CHANGES OF ALUMINIZED AND PT-ALUMINIZED NI-BASED SINGLE CRYSTAL SUPERALLOYS**
Kazuki KASAI, Shibaura Institute of Technology, Japan

6. **EVOLUTION OF RAFT STRUCTURE DURING CREEP DEFORMATION OF NI-BASED SINGLE CRYSTAL SUPERALLOY**
Nobuyasu Tsuno, IHI Corporation, Japan
7. **PREDICTION OF REACTION DIFFUSION PHENOMENA BETWEEN IR-COATING AND NI-AL ALLOY SUBSTRATE USING PHASE-FIELD MODEL**
Machiko ODE, Hideyuki MURAKAMI, National Institute for Materials Science, Japan
8. **EFFECTS OF HEAT TREATMENT ON MICROSTRUCTURES AND CREEP PERFORMANCES OF IN718**
Chen-Ming Kuo, I-Shou University, Taiwan
9. **EFFECTS OF REJUVENATION HEAT TREATMENT ON HIGH TEMPERATURE CREEP AND OXIDATION PROPERTIES OF RENE142 DS SUPERALLOY**
Chun-Yu Lin, I-Shou University, Taiwan, Chen-Ming Kuo, Department of Mechanical and Automation Engineering, I-Shou University,
10. **THE STRUCTURE AND HOT DEFORMATION BEHAVIOR OF ESR-CDS RENÉ88DT**
FENG Di, High Temperature Materials Division, Central Iron and Steel Research Institute, China
11. **THE EFFECTS OF ALLOYING ELEMENTS ON PLANAR FAULTS ENERGIES AND DISLOCATION MOVEMENT IN γ AND γ' PHASES OF NI-BASED SINGLE-CRYSTAL SUPERALLOYS**
Ping Yan, Central Iron and Steel Research Institute, China
12. **STUDY ON MICROSTRUCTURE AND PROPERTIES OF DIFFERENT POWDER METALLURGY SUPERALLOYS**
ZHANG Yiwen, High Temperature Materials Research Institute, CISRI, China
13. **DESIGN AND PROPERTIES OF NEW CAST AND WROUGHT SUPERALLOYS FOR TURBINE DISK APPLICATIONS**
Alexandre DEVAUX, Aubert & Duval, FRANCE; Yutaka Kamatani, Eramet International
14. **VERY HIGH TEMPERATURE CREEP BEHAVIOR OF MC2 SINGLE CRYSTAL NI-BASED SUPERALLOY UNDER COMPLEX THERMAL CYCLING CONDITIONS**
Jonathan Cormier, Institut Pprime, CNRS - ENSMA - Université de Poitiers, France
15. **THE ROLE OF CR ON THE SOLIDIFICATION PATH AND AS-CAST MICROSTRUCTURE OF $\text{Ni}_{3}(\text{Ni})/\text{Ni}_3\text{Al}$ (NI3AL)- $\text{Ni}_3(\text{Ni}_3\text{Nb})$ NI-BASE SUPERALLOYS**
Mengtao Xie, Illinois Institute of Technology (IIT), USA
16. **THE EFFECT OF CRYSTALLOGRAPHIC ORIENTATION ON COMPRESSIVE CREEP OF A NI-BASED SUPERALLOY CMSX4**
Osamu Shirahige, Department of Mechanical Engineering, Tokyo Metropolitan University, Japan
17. **EFFECTS OF DETRIMENTAL DIFFUSION ZONE AND HEAT TREATMENT ON CREEP STRENGTH OF ALUMINIZED NICKEL-BASED SINGLE CRYSTAL SUPERALLOYS**
Shunsuke Shimabayashi, Tokyo Metropolitan University, Japan
18. **PRECIPITATION AND CLUSTERING IN THE EARLY STAGES OF AGEING IN INCONEL 718**
Talukder Alam, Australian Key Centre for Microscopy and Microanalysis, The University of Sydney, Australia
19. **INVESTIGATION OF MICROSTRUCTURAL CHANGES OF POWDER PARTICLES DURING HVOF PROCESSING OF COATED SUPERALLOYS**
SJ Yan, Loughborough University, UK

20. **EFFECT OF THE HIP PARAMETERS ON THE MICRO-STRUCTURAL EVOLUTION OF A SX NI-BASED SUPERALLOY**
Inmaculada Lopez-Galilea, Ruhr University Bochum, Germany
21. **A NEW OXIDE MORPHOLOGY MAP: INITIAL OXIDATION BEHAVIOUR OF NI-BASE SINGLE CRYSTAL SUPERALLOYS**
Aya Suzuk Shin, High Temperature Materials Center, National Institute for Materials Science, Japan
22. **NEW RESULTS ON CREEP TESTING OF NI-BASED SUPERALLOYS WITH MINIATURIZED SPECIMENS**
P. Nörtershäuser, Institut für Werkstoffe, Ruhr-Universität Bochum, Germany
23. **THE PRECIPITATION OF TOPOLOGICALLY CLOSE-PACKED PHASES IN NI-RE-W ALLOYS**
F. Li, University of Cambridge/Rolls-Royce University Technology Centre, UK
24. **GRAIN GROWTH KINETICS OF NI-CO BASE DISK SUPERALLOY TMW-4M3 AT TEMPERATURES BELOW G' SOLVUS**
Toshio Osada, National Institute for Materials Science, Japan
25. **SEPARATING THE EFFECTS OF $\hat{\epsilon}^3$ - $\hat{\epsilon}^2$ LATTICE MISFIT AND MICROSTRUCTURAL INSTABILITY ON CREEP LIFE REDUCTION IN RUTHENIUM-BEARING SUPERALLOYS**
Cathie M.F. Rae, University of Cambridge, U.K.
26. **INFLUENCE OF MISORIENTATION ON TMF PROPERTIES OF AN SC SUPERALLOY CMSX-4**
X. Zhang, National Institute for Materials Science, Japan
27. **MICROSTRUCTURE AND CREEP STRENGTH OF DIFFERENT γ/γ' - STRENGTHENED CO-BASE SUPERALLOY VARIANTS**
Alexander Bauer, Department of Materials Science & Engineering, Institute I, University Erlangen-Nürnberg, Germany
28. **LOCAL MECHANICAL PROPERTIES AND THERMAL STABILITY OF BOND COATS STUDIED BY NANOINDENTATIONS AND ISOTHERMAL OXIDATION**
Ralf Webler, Department of Materials Science & Engineering, Institute I, University Erlangen-Nürnberg, Germany
29. **MECHANICAL CHARACTERIZATION OF THIN, FREESTANDING AL BOND COATS BY IN-SITU TENSILE TESTING**
Markus Krottenthaler, Department of Materials Science & Engineering, Institute I, University Erlangen-Nürnberg, Germany
30. **THIRTY-YEAR RESEARCH ON P/M NICKEL-BASED SUPERALLOYS FOR TURBINE DISKS IN THE USTB**
Benfu HU, University of Science and Technology Beijing, China