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Editors

D. Gandy
J. Shingledecker
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Contents

| | |
|----------------------|----|
| <i>Preface</i> | xv |
|----------------------|----|

Section 1: Technology Overview (Plenary Session)

| | |
|--|---|
| <i>The European Perspective and Advancements for Advanced USC Steam Power Plants</i> | 1 |
| Rudolph Blum and Jørgen Bugge | |

| | |
|--|----|
| <i>R&D Program for A-USC Material Development with Creep Strength/Degradation Assessment Studies</i> | 11 |
| Fujimitsu Masuyama | |

| | |
|---|----|
| <i>Structure Stability Study on Fossil Power Plant Advanced Heat-Resistant Steels and Alloys in China</i> | 30 |
| Xishan Xie, Chengyu Chi, Hongyao Yu, Qiuying Yu, Jianxin Dong, and Shuangqun Zhao | |

| | |
|---|----|
| <i>Economic Analysis of Advanced Ultra-Supercritical Pulverized Coal Power Plants: A Cost-Effective CO₂ Emission Reduction Option?</i> | 53 |
| Jeffrey N. Phillips and John M. Wheeldon | |

| | |
|--|----|
| <i>Fossil Materials Research at EPRI</i> | 65 |
| D. Gandy and J. Shingledecker | |

Section 2: USC Boiler Materials

| | |
|--|----|
| <i>Advances in Materials Technology for A-USC Power Plant Boilers</i> | 72 |
| Masaaki Igarashi, Hiroyuki Semba, Mitsuharu Yonemura, Tomoaki Hamaguchi, Hirokazu Okada, Mitsuru Yoshizawa, and Atsuro Iseda | |

| | |
|--|----|
| <i>GKM Test Rig: Investigation of the Long Term Operation Behavior of Tubes and Forgings Made of Alloys for Future High Efficient Power Plants</i> | 86 |
| K. Metzger, K.H. Czychon, K. Maile, A. Klenk, A. Helmrich, and Q. Chen | |

| | |
|--|----|
| <i>Optimization of INCONEL® Alloy 740 for Advanced Ultra Supercritical Boilers</i> | 96 |
| B.A. Baker, Ronald D. Gollihue | |

| | |
|--|-----|
| <i>Microstructural Evolution in Nimonic 263 for High Temperature Power Plant</i> | 110 |
| S.A. Smith, G.D. West, K. Chi, W. Gamble, and R.C. Thomson | |

| | |
|---|-----|
| <i>Long Term Properties and Microstructural Evolution of ASTM Grade 23</i> | 127 |
| S. Caminada, G. Cumino, L. Cipolla, S. Tiberi Vipraio, and A. Di Gianfrancesco | |
| <i>Evaluation of 18Cr-9Ni-3Cu-Nb-N Austenitic Stainless Tubes for Ultra-Supercritical Power Boiler</i> | 140 |
| Zheng Kaiyun, Wang Yanfeng, and Cui Zhengqiang | |
| <i>Long-Term Creep Properties of 2.25Cr-1.6W-VNb Steel (T23/P23) for Fossil Fired and Heat Recovery Boilers</i> | 153 |
| H. Okada, M. Igarashi, M. Yoshizawa, S. Matsumoto, T. Nakashima, and A. Iseda | |
| <i>Effect of Pre-Strain on Creep Properties of Alloy 740</i> | 164 |
| Keiji Kubushiro, Kyohei Nomura, Satoshi Takahashi, Madoka Takahashi, and Hirokatsu Nakagawa | |

Section 3: Oxidation and Fireside Corrosion

| | |
|---|-----|
| <i>The Effect of Heat Flux on the Steam Oxidation Kinetics and Scale Morphology of Low Alloy Materials</i> | 171 |
| A.T. Fry, L.J. Brown and J.P. Banks | |
| <i>Effect of Grain Size on Steam Oxidation for Shot-Peened Stainless Steels</i> | 185 |
| Y. Nishiyama, A. Iseda, M. Yoshizawa, S. Matsumoto, and M. Igarashi | |
| <i>Characterization of Steam-Formed Oxides on Candidate Materials for USC Boilers</i> | 198 |
| J.M. Sarver and J.M. Tanzosh | |
| <i>Steam-Side Oxide Scale Exfoliation Behavior in Superheaters and Reheaters: Differences in the Behavior of Alloys T22, T91 and TP347 Based on Computer Simulation Results</i> | 213 |
| Adrian S. Sabau, John P. Shingledecker, and Ian G. Wright | |
| <i>Characterization of Reaction Products from Field Exposed Tubes</i> | 243 |
| K.A. Unocic, B.A. Pint and I.G. Wright | |
| <i>Oxidation of Candidate Alloys and Coatings for A-USC Applications</i> | 254 |
| Terry C. Totemeier and Steven L. Goodstine | |
| <i>Modeling Fireside Corrosion of Heat Exchanger Materials in Advanced Energy Systems</i> | 255 |
| T. Lant, C. Keefe, C. Davies, B. McGhee, N. Simms, and T. Fry | |
| <i>Online Gas Measurements in a Pilot-Scale Combustion Facility for Fireside Corrosion Study</i> | 268 |
| Steven C. Kung | |

In Situ Corrosion Testing of Ultrasupercritical Tube and Weld Overlay Materials 288
E.S. Robitz and J.M. Tanzosh

Coal Ash Corrosion Properties of Ni-Based Alloy for Advanced-USC Boilers 303
Yasuhiro Tanaka, Nobuyoshi Komai, and Hiroshi Suganuma

Materials Performance of Oxyfuel Turbine Alloys 312
G.R. Holcomb and P. Wang

Section 4: USC Turbine Materials

Advanced USC Technology Development in Japan 325
Masafumi Fukuda, Eiji Saito, Yoshinori Tanaka, Takeo Takahashi, Shinji Nakamura,
Jun Iwasaki, Shinichi Takano, and Sakae Izumi

*The Role of Boron in Long Term Stability of a
CrMoCOB (FB2) Steel for Rotor Application* 342
A. Di Gianfrancesco, L. Cipolla, M. Paura, S. Tiberi Vipraio, D. Venditti,
S. Neri, and M. Calderini

*Effect of Grain Size on Mechanical Properties of Ni-Fe Base Superalloy for
Advanced USC Turbine Rotor Materials* 361
Satoru Ohsaki, Tatsuya Takahashi, Shinya Imano, Jun Sato, and Eiji Saito

*Low Thermal Expansion Ni-Base Superalloy for
700 C Class Steam Turbine Plant (USC141)* 373
H. Kamoshida, S. Imano, E. Saito, T. Uehara, T. Toga, and T. Nonomura

*Alloy Design of Ni-Base Superalloys Aiming for
Over 750°C Class A-USC Steam Power Plant* 386
Jun Sato, Hironori Kamoshida, Shinya Imano, Toshihiro Omori, and Kiyohito Ishida

*The Manufacture of Large, Complex Fossil Components Using
Powder Metallurgy and HIP Technologies—A Feasibility Study* 393
D. Gandy, J. Shingledecker, and L. Lherbier

*Creep Rupture Strength and Microstructural Investigation of
12% Cr Steel Large Forgings for Ultra-Supercritical Steam Turbine Rotors* 408
M. Mikami, Y. Wakeshima, and T. Miyata

*Development Status of Ni-Fe Base Superalloy for
700 °C Class A-USC Steam Turbine Rotor Application* 423
Shinya Imano, Jun Sato, Hironori Kamoshida, Eiji Saito, Koji Kajikawa,
Satoru Ohsaki, and Tatsuya Takahashi

| | |
|---|-----|
| <i>Advanced Forgings for Highly Efficient Fossil Power Plants</i> | 436 |
| N. Blaes, B. Donth, A. Diwo, and D. Bokelmann | |
| <i>Corrosion-Fatigue in Steam Turbine Blades</i> | 450 |
| R.N. Salzman, N.F. Rieger, S. Tschegg, B. Schönbauer, A. Turnbull, S. Zhou, and D. Gandy | |
| <i>High-Temperature Erosion Testing Standard and Round Robin Testing</i> | 470 |
| V.P. "Swami" Swaminathan, Jeffery S. Smith, and Dave Gandy | |

Section 5: Creep and Life Management

| | |
|---|-----|
| <i>Creep-Fatigue in Steam Turbine Materials</i> | 487 |
| S.R. Holdsworth | |
| <i>Validation of Creep Crack Growth NSW Model in Extrapolating Short-Term Laboratory Test Results to Longer-Term Service Component Failure Prediction</i> | 504 |
| Shervin Maleki, Yan-Hui Zhang, and Kamran Nikbin | |
| <i>Creep Behaviour of Advanced Power Plant Steels after Long-Term Isothermal Ageing</i> | 516 |
| V. Sklenicka, K. Kucharova, M. Svoboda, and A. Kroupa | |
| <i>Life Assessment of High Temperature Welded Components</i> | 530 |
| P. Carter, D.L. Marriott, J.F. Shingledecker, J.R. Foulds, and R.W. Swindemann | |
| <i>Nondestructive Evaluation Methods of Microstructure in Power Plant Steel Grades</i> | 554 |
| S. Meir, S. Liu, B. Mishra, D.L. Olson, A.N. Lasseigne, K. Coleman, and R. Hellner | |
| <i>The Effect of Service Aging on the Creep-Fatigue Properties of Alloy 617 Parent Metal and Welds</i> | 571 |
| W.L. Gamble | |
| <i>Creep and Creep-Fatigue Behavior of Grade 92 Base Metal and Welded Joints</i> | 584 |
| Y. Takahashi and D. Gandy | |
| <i>New Concepts for Integrity and Lifetime Assessment of Boiler and Turbine Components for Advanced Ultra-Supercritical Fossil Plants</i> | 603 |
| C. Feuillette, K. Schmidt, K. Maile, A. Klenk, and E. Roos | |

Section 6: 9% Cr Alloys

| | |
|---|-----|
| <i>Creep Deformation Behavior and Alloy Design Philosophy of Creep-Resistant Tempered Martensitic 9Cr Steel</i> | 620 |
| F. Abe | |

| | |
|---|-----|
| <i>Boron Strengthening in Ferritic 9Cr3W3CoVNbBN Steel with Improved Crossweld Creep Performance</i> | 640 |
| Peter Mayr, Ivan Holzer, Mihaela Albu, Gerald Kothleitner, Horst Cerjak, and Samuel M. Allen | |
| <i>Microstructural Degradation during High Temperature Exposure Up to 10⁵ H and Its Effects on Creep of Gr. 91 Steel</i> | 654 |
| R.P. Chen, H. Ghassemi Armaki, K. Maruyama, Y. Minami, and M. Igarashi | |
| <i>Effects of Variation of Phase Chemistry on Multi-Region Stress Rupture Properties at 625°C for P92 Steel</i> | 667 |
| Z.F. Peng, L.S. Cai, F.F. Peng, Y.P. Hu, and F.Y. Chen | |
| <i>The Effect of Duration of Stress Relief Heat Treatments on Microstructural Evolution and Mechanical Properties in Grade 91 and 92 Power Plant Steels</i> | 679 |
| L. Li, P. Zhu, G. West, and R.C. Thomson | |
| <i>Microstructural Evolution of P92 Steel during Creep</i> | 693 |
| Qinxin Zhao, Ting Li, Xiang Deng, and Dingnan Cheng | |
| <i>On Creep-Rupture Property Assessment for 9-12% Cr Ferritic Heat-Resistant Steels</i> | 705 |
| Z.F. Peng, Y.Y. Dang, and F.F. Peng | |
| <i>Key Life Management Issues with Grade 91 Steel</i> | 715 |
| Jonathan Parker and Kent Coleman | |
| <i>Long-Term Creep Strength Property of Advanced Ferritic Creep Resistant Steels</i> | 732 |
| K. Kimura, K. Sawada, and H. Kushima | |
| <i>Estimates for the Onset of Type IV Cracking in Grade 91 Power Plant Components</i> | 752 |
| S.J. Brett | |
| <i>P(T)91 Steel-A Review of Current Code and Fabrication Practices</i> | 762 |
| Pradip Goswami | |
| <i>The Effect of Simulated Post Weld Heat Treatment Temperature Overshoot on Microstructural Evolution in P91 and P92 Power Plant Steels</i> | 787 |
| R.C. MacLachlan, J.J. Sanchez-Hanton, and R.C. Thomson | |
| <i>Effect of Tempering on Microstructure and Properties of Grade 91 Steel</i> | 800 |
| Terry C. Totemeier and Ian J. Perrin | |

Section 7: Advanced Coating Technologies

| | |
|--|-----|
| <i>Evaluation of Nanocrystalline MCrAl Coatings for Power Plants</i> | 801 |
| N.S. Cheruvu, R. Wei, J. Shingledecker, and D.W. Gandy | |
| <i>Abradable Coatings Development and Validation Testing for Application on Steam Turbine Components</i> | 821 |
| Dieter Sporer, Scott Wilson, Petr Fiala, and Ruediger Schuelein | |
| <i>Performance of Al-Rich Oxidation Resistant Coatings for Fe-Base Alloys</i> | 839 |
| B.A. Pint | |
| <i>Nano-Structured Erosion Resistant Coatings for Gas and Steam Turbines</i> | 850 |
| V.P. “Swami” Swaminathan, Ronghua Wei, and David W. Gandy | |

Section 8: USC Castings

| | |
|---|-----|
| <i>Processing of Advanced Alloys for A-USC Steam Turbine Applications</i> | 872 |
| Paul D. Jablonski, Jeffery A. Hawk, Christopher J. Cowen, and Philip J. Maziasz | |
| <i>High-Temperature Control Valves for the 700°C Fossil Fired Power Plant</i> | 886 |
| B. Föllmer, K. Metzger, K. Maile, C. Hoffmann, and M. Rohr | |
| <i>High-Temperature Mechanical Properties and Microstructure of Cast Ni-Based Superalloys for Steam Turbine Casing Applications</i> | 900 |
| P.J. Maziasz, N.D. Evans, and P.D. Jablonski | |

Section 9: Advanced Stainless Steels

| | |
|--|-----|
| <i>Mechanical Properties and Microstructure of a Wrought Austenitic Stainless Steel for Advanced Fossil Power Plant Applications</i> | 916 |
| D. Gandy, J.P. Shingledecker, P.J. Maziasz, G. Maurer, J. Magee | |
| <i>Strain Induced Hardening of Advanced Austenitic Stainless Steels Evaluation of Creep Properties</i> | 933 |
| P. Moody and Doosan Babcock | |
| <i>Prediction of Microstructural Evolution in Austenitic Stainless Steels for Extended Life Power Plant Applications</i> | 949 |
| F. Zhu, R.G. Faulkner, R.L. Higginson, S. Spindler, A. Baker, and C.D. Hamm | |
| <i>Creep Rupture Properties of HR6W for Advanced-USC Boilers</i> | 962 |
| Nobuhiko Saito and Nobuyoshi Komai | |

| | |
|--|-----|
| <i>Sigma Phase Precipitation in 347HFG Stainless Steel for Supercritical Power Plant Operation</i> | 972 |
| D. West, J. Hulance, R.L. Higginson, and G. Wilcox | |

| | |
|--|-----|
| <i>Mechanical Properties and Microstructures of an S304H-Type Steel Subjected to Hot Working</i> | 986 |
| Z. Yanushkevich, A. Mogucheva, M. Tikhonova, A. Belyakov, and R. Kaibyshev | |

Section 10: Weld Performance

| | |
|--|-----|
| <i>Weldability of EPRI P87</i> | 995 |
| J.A. Siefert, J.M. Tanzosh, and J.P. Shingledecker | |

| | |
|---|------|
| <i>Toughness Evaluation of Welds in 9Cr-1Mo-V and 9Cr-0.5Mo-V Steels Made Using the Flux-Cored Arc Welding (FCAW) Process</i> | 1014 |
| C.E. Jaske, Z. Berg, and T. Andress | |

| | |
|---|------|
| <i>Flux Cored Wires for High Integrity Applications</i> | 1030 |
| William F. Newell, Jr. | |

| | |
|--|------|
| <i>Weldability of Inconel® Alloy 740</i> | 1045 |
| J.A. Siefert, J.M. Tanzosh, and J.E. Ramirez | |

| | |
|--|------|
| <i>Long-Term Creep Rupture Strength of Weldment of Candidate Ni and Fe-Ni Based Materials for Tube and Pipe of A-USC Boilers</i> | 1067 |
| G. Bao, T. Sato, and Y. Marumoto | |

Section 11: Reference Information

| | |
|---------------------------|------|
| <i>Author Index</i> | 1077 |
|---------------------------|------|

| | |
|----------------------------|------|
| <i>Subject Index</i> | 1081 |
|----------------------------|------|

Preface

Over 180 participants from 16 countries traveled to Santa Fe, New Mexico, to be part of the EPRI Sixth International Conference on Advances in Materials Technology for Fossil Power Plants. The four-day conference featured a combination of invited plenary talks, session keynote papers, and technical presentations covering a wide range of subjects pertaining to the use and development of materials for fossil power plants and provided a unique forum for exchange between scientists, engineers, and utilities. This proceeding builds on the successful previous conferences which have been held every three years since 1995 in the following locations: London (England), San Sebastian (Spain), Swansea (Wales), Hilton Head Island (United States), and Marco Island (United States). ASM and EPRI have partnered to publish the last two proceedings and are now pleased to present this volume. In this proceedings, 80+ papers have been included capturing the current state-of-the-technology developments (Section 1), ultrasupercritical (USC) boiler materials (Section 2), oxidation and fireside corrosion (Section 3), USC turbine materials (Section 4), creep and life management (Section 5), 9% chromium alloys (Section 6), advanced coating technologies (Section 7), USC castings (Section 8), advanced stainless steels (Section 9), and weld performance (Section 10).

The genesis of this conference and the reason for its success, even amidst a global recession and reduced energy demand, is the worldwide interest in advanced high-efficiency coal power plants. The abundance of coal and the need to maintain a viable coal option, fuel prices, and most importantly the requirements to reduce emissions and CO₂, provide the impetus for improved plant efficiency. The net thermal efficiency of fossil plants has improved from 33% high-heating value (HHV) in the case of the aging fleet of “subcritical plants” to nearly 42% HHV for supercritical plants operating under steam conditions of 1100°F/3600 psi (593°C/25 MPa). To boost efficiencies above 45% HHV, research and development projects are being carried out in Europe, the United States, and Japan on Ultrasupercritical (USC) powerplants (now emerging around the globe with operation above 1100°F/3600psi) and Advanced Ultrasupercritical (A-USC) power plants that can operate at steam conditions of 1300°F/4000 psi (700°C/28 MPa) and above. In Europe, in-plant demonstrations of prototype A-USC components are under way. In the United States, a five-year effort, aimed at A-USC boiler and steam turbine material qualification, has been completed and follow on work under phase 2 is in progress. Additionally, material advancements are now being made to integrate these A-USC technologies with oxyfuel combustion as an attractive option for carbon sequestration.

The key enabling technology that drives high-efficiency power plants is the development of advanced materials and coatings with a considerable increase over traditional alloys in creep strength and corrosion resistance. Major strides have been made in 9–12% chromium (Cr) ferritic steels containing boron (B), cobalt (Co), tungsten (W), and other elements for both boilers and steam turbines that are capable of operating at temperatures of up to ~1150°F (625°C). To operate beyond this limit, vastly improved austenitic steels and alloys such as HR3C, NF 709, Super 304 H, 347 HFG, HR6W, are being evaluated. For operation above 1300°F (700°C) nickel-based alloys such as Inconel 740, alloy 230, 617, 263, and Haynes 282 are needed. Optimization of component fabrication processes including forming, welding, casting and forging are a critical factor in serviceability of these alloys.

Research on these topics and materials are covered in the Proceedings.

Finally, the conference featured a special Honorary Session for the retirement of Professor Vis Viswanathan (FASM) in which many of his outstanding achievements were described by long time colleagues and friends. This was a remarkable and deserved tribute to one of the commanding figures of his generation in the field of power engineering materials. His contributions to the field cannot be understated.

D. Gandy and J. Shingledecker

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