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This book is a collection of papers presented at a symposium on "Materials Lifetime Science and Engineering" sponsored by the Mechanical Behavior of Materials Committee of The Minerals, Metals & Materials Society (TMS) and ASM International. The symposium took place at the 2003 TMS Annual Meeting, San Diego, California, March 2 – March 6. The objective of the symposium was to provide fundamental understanding and theoretical modeling of materials lifetime science and engineering of metals and alloys including advanced materials. Advanced materials include biomaterials, bulk metallic glasses, intermetallics, composites, superalloys, etc.

The most complex and often most damaging processes that control the lifetimes of structural materials are those that involve synergistic interactions between environmental and mechanical effects. Mechanistic understanding and modeling are needed to further develop materials lifetime science and engineering, and formulate predictive methodologies. Emphases are placed on mechanical/environmental interactions, damage evolution, and final failure. Some of the areas explored are as follows:

1. Lifetime Studies of Conventional Materials in Aqueous Environments
2. Lifetime Studies of Advanced Materials in Aqueous Environments
3. Lifetime Studies of Advanced Materials in High-Temperature Gaseous Environments
4. Lifetime Studies of Oxide Scales in High-Temperature Gaseous Environments.

The symposium attracted scientists and engineers from universities, industries, and government agencies worldwide. We were very much encouraged by the turnout of the participants with strong interest in the research and application of materials lifetime science and engineering. The symposium was highlighted by thoughtful discussions and technical interchanges among the participants.

We would like to thank all of the participants for the success of the symposium, and the authors for their excellent contributions to the book. We are confident that this book will provide invaluable reference information for the research on "Materials Lifetime Science and Engineering."

It is our belief that it is only through vigorous research on and understanding of "Materials Lifetime Science and Engineering," the engineering applications of materials can then become a common practice.

The symposium organizers were Peter K. Liaw and Raymond A. Buchanan of the University of Tennessee, Dwaine L. Klarstrom of Haynes International, Inc., Robert P. Wei and D. Gary Harlow of Lehigh University, and Peter F. Tortorelli of Oak Ridge National Laboratory.
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Dr. P. K. Liaw                           Dr. R. A. Buchanan Dr. D. L. Klarstrom  
The University of Tennessee                           The University of Tennessee                           Haynes International, Inc.  
Knoxville, TN 37996-2200                           Knoxville, TN 37996-2200                           P. O. Box 9013  
Tel: (865) 974-6356 Tel: (865) 974-4858 Tel: (765) 456-6925  
Fax: (865) 974-4115 Fax: (865) 974-4115 Fax: (765) 456-6218  
E-mail: pliaw@utk.edu E-mail: rab1@utk.edu Email:dklarstrom@haynesintl.com  

Dr. R. P. Wei                           Dr. D. G. Harlow Dr. P. F. Tortorelli  
Lehigh University                           Lehigh University                           Oak Ridge National Lab.  
Mechanical Engineering                           Mechanical Engineering                           Corrosion Group  
& Mechanics, 7 Asa Drive                           & Mechanics, 19 Memorial                           1 Bethel Valley Road  
Bethlehem, PA 18015                           Dr. West, Bethlehem, PA 18015                           Oak Ridge, Tennessee 37831  
Tel: (610) 758-3587 Tel: (610) 758-4127 Tel: (865) 574-5119  
Fax: (610) 758-6555 Fax: (610) 758-6224 Fax: (865) 574-5119  
E-mail: rpw0@lehigh.edu E-mail: dgh0@lehigh.edu E-mail: pft@ornl.gov
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