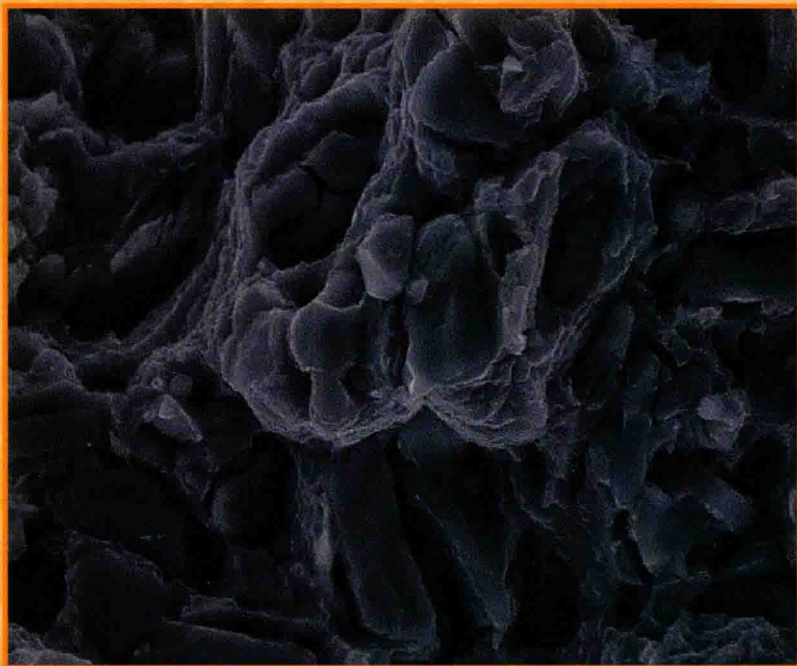


# **ADVANCED COMPOSITES**

**for AEROSPACE, MARINE,  
and LAND APPLICATIONS II**



*Editors*

**T. Sano • T. S. Srivatsan**

**TMS**

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*Proceedings of a symposium sponsored by*  
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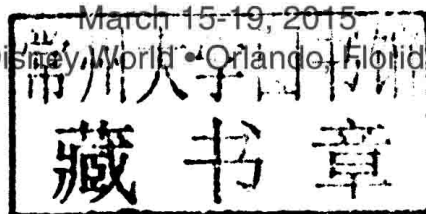
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**Cover Photograph:** Scanning electron micrograph of the tensile fracture surface of the 2014/Al<sub>2</sub>O<sub>3</sub>/10p composite deformed in tension showing noticeable failure by cracking of the reinforcing particulates. Further details can be found in the technical manuscript "Influence of Reinforcement Content on Tensile Response and Fracture Behavior of an Aluminum Alloy Metal Matrix Composite" by K. Manigandan, T. S. Srivatsan, Zhencheng Ren, and Jingyi Zhao.

# TMS2015

## 144<sup>th</sup> Annual Meeting & Exhibition

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**New proceedings volumes from the TMS2015 Annual Meeting,  
available from publisher John Wiley & Sons:**

- 6th International Symposium on High-Temperature Metallurgical Processing
- Advanced Composites for Aerospace, Marine, and Land Applications II
- Advances in the Science and Engineering of Casting Solidification
- Characterization of Minerals, Metals, and Materials 2015
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## PREFACE

The use of advanced composites has increased in recent years, often replacing heavier monolithic materials for structural applications. The high demand for composites is also seen in the transportation and defense industries. To explore the growth of composite knowledge and to promote communication of recent composite research for aerospace, marine, and land applications, the international symposium titled "Advanced Composites for Aerospace, Marine, and Land Applications II" was held during the TMS 2015 Annual Meeting & Exhibition in Orlando, Florida, USA, March 15-19, 2015. This symposium was the second in the series on the topic of advanced composites and was well-represented with abstracts from United States and international engineers and scientists from academia, research laboratories, and industries. This volume contains many of the papers presented in the five-session symposium, sponsored by the Composite Materials Committee of TMS (The Minerals, Metals & Materials Society). Over 46 abstracts were approved for presentation at this symposium and were divided into five sessions:

- Session 1:       Advanced Processing Techniques
- Session 2:       Metal Matrix Composites
- Session 3:       Composite Microstructure and Mechanical Properties
- Session 4:       Advanced Composites and Syntactic Foams
- Session 5:       Carbon Fiber Reinforced Composites and Modeling & Simulations

In these five sessions, recent advances in composite materials processing, characterization, properties, and modeling specifically for aerospace, marine, or land applications were presented. Each presenter brought new knowledge and ideas to the symposium, and we, the symposium organizers, extend our warmest thanks and appreciation to the presenters and participants. We also extend our most sincere thanks and appreciation to the elected and governing representatives of TMS for their understanding and acknowledgment of our interest, and timely approval of our request to organize this intellectually stimulating symposium.

Profuse gratitude and appreciation are extended to Ms. Trudi Dunlap (Programming Manager at TMS) for her sustained attention, assistance, interest, involvement, and timely participation stemming from understanding. Ms. Dunlap ensured a timely execution of the numerous intricacies related to both orchestration and layout of this symposium from the moment following its approval through the compilation and publication of this proceedings publication. Special thanks and much deserved appreciation is extended to Ms. Patricia Warren (Programming and Proceedings Specialist at TMS) for her patience, understanding, and much valued and desired attention as well. Also, the timely publication of this bound volume would not have



been possible without the cooperation of the authors and the publishing staff headed by the dedicated Content Senior Manager, Mr. Matt Baker at TMS.

We hope that this bound volume will provide the readers new perspectives and directions in their composite research. The growth and demand of composite materials will only continue and we hope that we have assisted the aerospace, marine, and land engineering and science community in reaching composite material research and application goals.

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## SYMPOSIUM ORGANIZERS

### **Tomoko Sano**

Dr. Tomoko Sano, Materials Engineer, U.S. Army Research Laboratory, received her M.S. in Materials Science and Engineering at Carnegie Mellon University in 2001 and her Ph.D. in Materials Science and Engineering at Carnegie Mellon University in 2005. After a postdoctoral fellowship at the U.S. Army Research Laboratory, she was appointed the Technical Assistant to the Director of the Weapons and Materials Research Directorate, where she was awarded three special act awards for the technical execution of directorate level assignments and programmatic actions. She is currently a materials engineer in the Materials and Manufacturing Science Division of the Weapons and Materials Research Directorate of the U.S. Army Research Laboratory, Aberdeen Proving Ground, Maryland. Her expertise and interests are in mesoscale microstructural and micromechanical characterization, and she conducts research to correlate processing, microstructure, and properties.



Dr. Sano has been the first author of over 20 technical publications including 2 book chapters, has been the first editor of three books, and presented over 20 conference presentations. She is an active member of the TMS Composite Materials Committee, serving as the *JOM* liaison in 2012 and 2014.

## T.S. Srivatsan

Dr. T.S. Srivatsan is Professor of Materials Science and Engineering in the Department of Mechanical Engineering at The University of Akron. He received his graduate degrees (Master of Science in Aerospace Engineering in 1981) and Doctor of Philosophy in Mechanical Engineering in 1984) from Georgia Institute of Technology. Dr. Srivatsan joined the faculty in the Department of Mechanical Engineering at The University of Akron in August 1987. Since joining, he has instructed undergraduate and graduate courses in the areas of (a) Advanced Materials and Manufacturing Processes, (b) Mechanical Behavior of Materials, (c) Fatigue of Engineering Materials and Structures, (d) Fracture Mechanics, (e) Introduction to Materials Science and Engineering, (f) Mechanical Measurements, (g) Design of Mechanical Systems, and (h) Mechanical Engineering Laboratory. His research areas currently span the fatigue and fracture behavior of advanced materials to include monolithic(s), intermetallic, nanomaterials and metal-matrix composites; processing techniques for advanced materials and nanostructure materials; inter-relationship between processing and mechanical behavior; electron microscopy; failure analysis; and mechanical design. He has authored/edited/co-edited 55 books in areas cross-pollinating mechanical design; processing and fabrication of advanced materials; deformation, fatigue and fracture of ordered intermetallic materials; machining of composites; failure analysis; and technology of rapid solidification processing of materials. He serves as co-editor of *International Journal on Materials and Manufacturing Processes* and is on the editorial advisory board of other journals in the domain of materials science and engineering. His research has enabled him to deliver over 200 technical presentations in national and international meetings and symposia; technical/professional societies; and research and educational institutions. He has authored and co-authored over 650 archival publications in international journals, chapters in books, proceedings of national and international conferences, reviews of books, and technical reports. In recognition of his efforts and contributions and their impact on furthering science, technology, and education he has been elected Fellow of the ASM International, Fellow of American Society of Mechanical Engineers (ASME), and Fellow of American Association for the Advancement of Science (AAAS). He has also been recognized as Outstanding Young Alumnus of Georgia Institute of Technology and Outstanding Research Faculty at the College of Engineering at The University of Akron. He offers his knowledge in research services to the U.S. Government (U.S. Air Force and U.S. Navy), National Research Laboratories, and industries related to aerospace, automotive, power-generation, leisure-related products, and applied medical sciences.



## **SESSION CHAIRS**

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Air Force Research Laboratory

**Dr. Alicia Esther Ares**  
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**Dr. Christopher Muhlstein**  
Georgia Institute of Technology

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U.S. Army Research Laboratory

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German Aerospace Center (DLR)

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Food and Drug Administration

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**Dr. T. S. Srivatsan**  
The University of Akron



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