A Comparative Study of Ti-6Al-4V Alloys Fabricated by Three Powder-Based Additive Manufacturing Technologies: Integrative Design for Fatigue Performance and New Methods for Rapid Material/Part Qualification

There are many additive manufacturing (AM) processes that have been used for the fabrication and repair of Ti-6Al-4V components, and it is important to keep in mind that similar alloys produced using various manufacturing methods will exhibit different mechanical properties due to the unique thermal history of each process. This study systematically examines and compares the processing-microstructure-property relationships in Ti-6Al-4V alloys produced using three powder-based AM technologies: Laser Engineered Net Shaping (LENS), Laser Powder Bed Fusion (LPB), and Electron Beam Powder Bed Fusion (EBM). First, the thermal histories, microstructure evolutions, and tensile properties of the materials will be presented and discussed. Further, the fatigue crack growth behavior for different orientations (with respect to the deposition direction), stress ratios, and heat-treating conditions will be addressed, and damage mechanisms at the microstructural scale at different crack growth stages will be identified. The results will then be reviewed from the perspective of design for fatigue resistance and life predictions in high-integrity applications. Opportunities and directions towards qualifying structural AM parts will also be discussed, and a new and effective methodology for rapid materials characterization and optimization for fatigue performance will be proposed.

SPEAKER BIO: Diana A. Lados, FASM.
Worcester Polytechnic Institute
Milton Prince Higgins II Distinguished Professor
Director, Integrative Materials Design Center
100 Institute Road, Worcester, MA 01609

Dr. Diana Lados is the Milton Prince Higgins II Distinguished Professor at Worcester Polytechnic Institute (WPI), and the Founder and Director of the Integrative Materials Design Center (iMdc), an industry-government-university consortium established at WPI in 2007, dedicated to advancing the frontiers of sustainable materials-process-component design and manufacturing for high-performance and reliability. She received her B.S./M.S. in Mechanical Engineering from Polytechnic University of Bucharest in 1997, her second M.S. in Mechanical Engineering from Southern Illinois University in 1999, and her Doctorate in Materials Science and Engineering from WPI in 2004. Dr. Lados is credited with significant research contributions in the areas of materials design, characterization, evaluation, and computational modeling for fatigue, fatigue crack growth, and high-temperature performance, as well as for her original work in materials processing and advanced manufacturing. Dr. Lados is the recipient of numerous awards and honors, including ASM Fellow–Class of 2017, 2014 Brimacombe Medal from TMS, 2014 Ralph R. Teetor Educational Award from SAE, 2013 Inaugural Constance Tipper Silver Medal from the World Academy of Structural Integrity, 2012 ASM Silver Medal, a
“Woman to Watch” in New England for innovation and leadership, an NSF-CAREER Award, and was chosen in 2010 by the National Academy of Engineering (NAE) to participate in the prestigious Frontiers of Engineering symposia for both exceptional research and innovative education. She has more than 85 publications, 250 technical presentations and invited lectures, and several book and patent contributions. She is a member of several professional societies (including ASM, TMS, Alpha Sigma Mu, Sigma Xi), organized symposia at international conferences, and chaired several committees (including Metallurgical and Materials Transactions A Board of Review, Material Advantage Committee, WPI Chapter of Sigma Xi, Central Massachusetts Chapter of ASM). Dr. Lados serves on the ASM’s Awards Policy Committee, and is the Vice President of Alpha Sigma Mu.

DINNER/MEETING LOCATION:  J Roo’s Restaurant
243 State Street, North Haven CT 06473
Members/Guests $25.00,   Retirees $20.00,  Full-time Students $Free
Social Hour ................................................................. 5:30 – 6:00 PM
Dinner Buffet. ............................................................... 6:00 PM
    (Garden Salad, Penne Ala Vodka, Herb Encrusted Salmon, Chicken Francaise)
Presentation............................................................... 7:00 PM


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