DMSE Semester Colloquia Series

Tuesday, January 22, 2019

White 411 at 4:00pm

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Nature and Origins of Weld Cracking at Elevated Temperatures

A major factor influencing the "weldability" of many high-performance alloys used in aerospace and energy applications is the formation of cracks at high temperatures in the weld fusion and heat-affected zones. Since the 1940's, literally hundreds of fundamental and applied R&D studies have been performed by the aerospace industry, academia and the government in an effort to understand the mechanisms of elevated-temperature cracking (i.e., "hot cracking") and, based on that understanding, develop approaches for reducing or eliminating this significant problem, including the design of more cracking-resistant alloys. This research has stimulated the development of innovative weldability testing tools and techniques to measure and comparatively evaluate alloy cracking susceptibility. These studies have also extensively utilized advanced metallurgical characterization tools and techniques, particularly analytical-electron microscopy, to better understand complex weld melting and solidification phenomena, and high-temperature solid-state phase transformations that are fundamental to the origins of this type of weld cracking. This presentation will discuss the metallurgical mechanisms for weld fusion zone solidification cracking, weld heat-affected zone and fusion zone liquation cracking, and solid-state cracking (e.g., reheat cracking). Specific examples of these cracking forms in selected Fe and Ni-base superalloys, Al-base alloy, Mg-base alloys and Ti-base alloys will be reviewed with a primary focus on explaining the metallurgical origins of cracking, and how that understanding can be applied to explain relative cracking susceptibilities. Based on the understanding of these cracking mechanisms, practical approaches for reducing or eliminating high-temperature cracking will be presented.

Biography:

William A. "Bud" Baeslack is a Professor of Materials Science and Engineering at Case Western Reserve University. Baeslack received his Ph.D. degree in Materials Engineering from Rensselaer Polytechnic Institute and his B.S and M.S. degrees in Welding Engineering from The Ohio State University. Following graduation from RPI he served four years at the U. S. Air Force Materials Laboratory as a materials engineer, group leader and technical area manager. Baeslack is internationally recognized for his research on the materials science and engineering aspects of joining advanced aerospace materials, including titanium, aluminum, nickel-base superalloys, intermetallics and metal-matrix composites. His work has been supported by the Office of Naval Research, the Army Research Office, the Air Force Office of Scientific Research, the Ohio Edison Program, national laboratories and industry. Baeslack and his students have authored over one hundred and fifty journal and proceedings articles. He has been elected a Fellow of three professional societies and has received numerous university and national awards for teaching and research. In 1989-90, Baeslack spent a sabbatical leave at The Welding Institute in Cambridge, England.

From 2008 to 2018 Baeslack served as Provost and Executive Vice President at Case Western Reserve University. Prior to joining CWRU, he served as Dean of the College of Engineering and Executive Dean of the Professional Colleges at The Ohio State University. Baeslack began his academic career as an Assistant Professor at OSU in 1982. As an academic administrator at OSU from 1991 to 1999, he served as Department Chair, Associate Dean for Research and College Development, Interim Vice President for Research and President of the OSU Research Foundation. From 1999 to 2004, Baeslack served as Dean of the School of Engineering at Rensselaer Polytechnic Institute. He returned to OSU in 2004.