

MATERIALS SCIENCE AND ENGINEERING (MS&E) SEMINAR SERIES

Friday, October 23, 2020 at 3:00 pm via Zoom

https://wvu.qualtrics.com/jfe/form/SV_80QQi6E8CUXmzwF**“Laser-Material Interaction Mechanism in Laser-based Directed Energy Deposition Process”****Zhichao Liu, Ph.D., Assistant Professor**

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Abstract: Laser-based directed energy deposition (DED) has become one of the core technologies in laser additive remanufacturing, metallic coating, and special components fabrication. Although DED process offers plenty of advantages over conventional fabrication technologies, the part quality may vary significantly even with slight variations of the input parameters. In addition, the material deposition process is hard to control due to the lack of understanding of the dynamic laser-material interactions in DED, such as particle-gas interaction, power-powder interaction, and molten pool-substrate interaction. In order to achieve compact and sound deposited layers, to realize high level fabrication and remanufacturing, as well as to interpret the property variations under different experimental conditions, these dynamic processes need to be fully understood.

This talk will initially describe laser-material interactions in DED process of nickel-based super alloy (Inconel 718). Three highly interrelated works will be discussed: 1) Molten pool energy requirement in DED of Inconel 718, to acquire an energy density interval so as to obtain the desired material properties; 2) Powder stream distribution under four jet exit nozzles, to figure out the powder concentration at different positions below the deposition head; and 3) Power absorption by the powder stream, to reveal the relationship between the material properties, input parameters and power absorption for Inconel 718. The outputs of the research could help to interpret the variations of mechanical property occurred in LDAM process and to predict the correct processing conditions for other materials.

Biography: Dr. Zhichao Liu received his Ph.D. from Texas Tech University in Industrial Engineering in 2019. After graduation, he joined the Department of Industrial and Management Systems Engineering at West Virginia University as an Assistant Professor. Dr. Liu’s research focuses on developing a fundamental understanding of the laser-material interaction and molten pool behaviors of material mixing, energy transition, and solidification in laser-based DED, aims to manipulate DED into novel applications of high-added-value components repair and direct fabrication. He has published more than 50 academic works including journal articles, conference papers, book chapters. He is a member of ASME, SME, IMSE and ASEE.

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