

Investigating the Microstructure and Mechanical Behavior of the particle-particle and substrate-particle interfaces in cold sprayed coatings

Tanvi Ajantiwalay¹, Sridhar Niverty¹, Rajib Kalsar¹, Arun Devaraj², Vineet V. Joshi¹

¹Energy and Environmental Sciences Directorate, Pacific Northwest National Laboratory

²Physical and Computational Sciences Directorate, Pacific Northwest National Laboratory

During cold spray, powder particles undergo severe plastic deformation upon impact with the substrate. This results in particle flattening, oxide breakage, and metallurgical bond formation at particle-particle and substrate-particle interfaces. At smaller length scales, heterogeneity of the bond coating can create property differences, which are yet to be explored. Thus, a comprehensive understanding of local interfacial bond strength at this heavily deformed interface would assist in designing optimal cold spray processes. In this study, we investigated the microstructure and mechanical properties of zinc (Zn) cold sprayed on AZ91 magnesium (Mg) substrates via correlative microscopy and in situ micro-tensile testing. Micro-tensile dogbones fabricated using Plasma Focused Ion Beam (PFIB) were tested in a displacement-controlled mode to estimate the interfacial strength and live deformation behavior.