Advancements in Profilometry-based Indentation Plastometry for Detecting Spatial Variations of Cold-Sprayed Metals

Astrid Rodriguez Negron[1], Anil Lama[1], Denny John[1], Abhijith Sukumaran[1], Arvind Agarwal[1], Aaron Tallman[1]

[1]Department of Mechanical and Materials Engineering, Florida International University, 10555 West Flagler Street, Miami, FL 33174

Cold spray (CS) additive manufacturing of metals produces novel and complex microstructures. Proflometry-based indentation plastometry (PIP) is a method that can be used to study the spatial variation in bulk plastic response via a series of indentation measurements. PIP could potentially be used to detect the variation made by the deposition process of CS; however, uncertainty in the PIP test can significantly impede accurate estimation of the variability. To mitigate the uncertainty of the PIP procedure to enable the estimation of spatial variability of bulk plastic response in the mm length scale optical profilometry, a non-contact measurement technique that generates a 3D surface profile of the material, is used to augment the profile measurements of a series of indentations to quantify the uncertainty using Al 7075. Here we study how Profilometry-based indentation plastometry may be a suitable test to detect the variations in plastic response in cold-sprayed metals that could provide valuable insights for developing microstructure-sensitive models in cold-spray additive manufacturing.