Influence of Hydrogen Content on the Microstructure of Tantalum Cold Spray Coatings

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The effect of tantalum feedstock powder impurities on the mechanical properties of the resulting cold spray coatings is investigated through high resolution characterization of the coatings' microstructures. A difference in mechanical behavior has been observed between coatings produced from nominally identical tantalum feedstock powders differing only in the concentration of hydrogen impurities introduced during processing. Scanning electron microscopy (SEM), Transmission Electron Microscopy (TEM) and Precession Electron Diffraction (PED) studies are carried out in order to understand and characterize the microstructures of two tantalum cold spray deposits with varying hydrogen concentrations.

The removal, or "jetting" of the particles' native oxide layer is critical to the bonding process during cold spraying. Therefore, any differences in the behavior of the oxide layer of the two powder feedstocks would result in different bonding, and consequently different microstructures. TEM was used to identify and characterize the location of the initial particles' native oxide layer within the microstructure of the resulting cold spray coating. Preliminary Energy Dispersive Spectroscopy (EDS) work has revealed segregation of oxygen to certain boundaries within the coating. Precession electron diffraction (PED) was used to investigate the crystallographic direction of grains, and the degree of misorientation between boundaries at the particle/particle interface.