Metal Matrix Composites: Approaching Helium Properties with Nitrogen Carrier Gas

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High quality cold spray coatings with good mechanical properties are usually deposited using helium process gas. Due to the high price of helium, nitrogen has become a popular alternative process gas. However, cold spray coatings using nitrogen process gas usually have inferior mechanical behavior, thus reinforcement particles were added to improve the mechanical behavior of the coating. Metal matrix composites were produced using zirconia-based reinforcement powder added to aluminum alloy Al6061 cold spray coatings and deposited on Al6061 aluminum, and ZE41 magnesium alloy substrates using nitrogen carrier gas. Microstructural analysis was performed using optical microscopy, electron microscopy, and electron backscattered diffraction. Mechanical properties of the coatings were investigated using microhardness, adhesion strength, shear strength, and tensile strength of coatings. Analysis of the results showed improvements in the mechanical properties of coatings produced using nitrogen process gas and zirconia-based reinforcement powder approach the mechanical properties of coatings produced using helium process gas.