

CSAT Poster Presentation

Cold Spray Deposition of High Strength Composite Coatings of Aluminum High Entropy Alloy and Aluminum 6061

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Commercial aluminum (Al) alloys are restrained by the maximum strength achievable from their polycrystalline structure. This limits the employment of these alloys as high-strength coatings for structural load-bearing applications. To circumvent this problem, two Al alloy combinations are employed in the present study to manufacture high-strength coatings by cold spray (CS) deposition. They utilize the inherent strength of atomic disorder in a novel Al high entropy alloy (Al HEA) coupled with the ductility of polycrystalline Al6061. Two cold sprayed coatings are manufactured, the first being a pure Al HEA and the second Al HEA mixed with Al 6061 in a ratio of 1:1 by weight. Higher ductility of Al 6061 enables deposition of thicker, 4.0 mm composite coatings compared to thinner, 0.3 mm deposits of pure Al-HEA. Microstructure of these coatings comprises three distinct regions, namely, featureless amorphous Al-HEA, partially crystallized Al-HEA, and polycrystalline Al6061. These regions exhibit a localized hardness of 481, 351, and 97 HV respectively, as measured by a Vickers microhardness tester. Individual contributions from these localized regions combine to manifest a bulk hardness of 440 and 261 HV in the pure Al HEA and the composite coating respectively. Together with the bulk elastic modulus investigation, this study advances state-of-the-art cold spray deposition of high strength and lightweight Al alloys.

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