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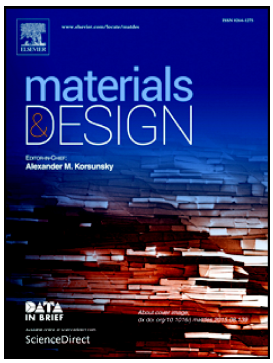

Thermo-mechanical post-treatment: A strategic approach to improve microstructure and mechanical properties of cold spray additively manufactured composites

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Thermo-mechanical post-treatment: a strategic approach to improve microstructure and mechanical properties of cold spray additively manufactured composites

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Abstract

In recent time, cold spray additive manufacturing (CSAM) has emerged as a promising solid state manufacturing technique to produce thick deposits of pure metal, alloys and composites with limited risk of oxidation, phase transformations, and residual thermal stresses. This preliminary study highlights an effective post spray thermo-mechanical treatment (TMT) that can be used to efficiently heal out splat boundaries and rejuvenate mechanical properties of the as-sprayed composite. CSAMed B_4C/Al composite was subjected to a series of TMTs via heating at ~ 500 ^oC in the furnace for 2 hrs followed by unidirectional rolling treatments with thickness reductions of 20, 40 and 60 % in 1, 2 and 3 passes, respectively. Microstructural investigations revealed that as the thickness reduction was increased from 20 %, matrix grains were extensively refined due to continuous dynamic recrystallization (CDRX). Moreover, bonding between Al/Al splats and B_4C/Al interface was remarkably improved due to enhanced inter-particle diffusion activity. Consequently, yield strength (YS), ultimate tensile strength (UTS) and elongation (EL) of the as-