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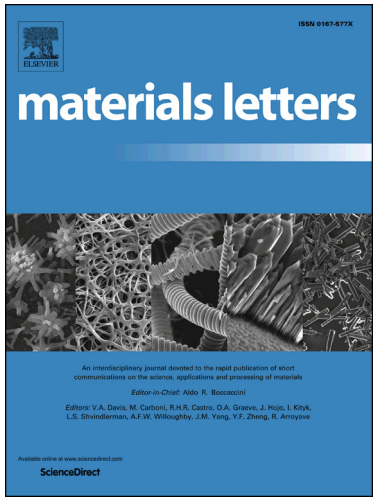

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Complex Concentrated Coatings: Effect of Processing Route on Microstructural and Mechanical Properties

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Abstract

We investigated the structure-property correlation for the complex concentrated alloy (CCA) coatings prepared using different precursor powders. $Al_3CoCrFeNi$ CCA precursor powders were prepared through mechanical alloying (MA) (ball milling) and direct mixing (DM). CCA coatings were developed using microwave technique through hybrid heating approach. Coatings showed good metallurgical bonding with substrate with cellular growth structure. Microstructure for both coatings was primarily composed of A2 phase segregated with B2 phase at intercellular region. CCA coatings with different precursors showed insignificant influence on hardness, elastic modulus and cavitation erosion. Nonetheless, coating developed with MA precursor showed slightly lower fracture toughness compared to DM, mainly attributed to inherently higher fraction of intermetallic B2 phase. We showed that direct mixing is an efficient and effective route for developing CCA coatings.

1. Introduction

Recently emerged, complex concentrated alloys (CCAs) contain five or more principal elements with equimolar or nearly equimolar concentration compared to conventional single principal element alloys [1]. Elements mixed in equimolar fraction maximizes entropy contributing to a stabilized solid solution. CCAs demonstrate exceptional mechanical and tribological properties and extremely high corrosion resistance highlighting their capability to withstand extreme working conditions [2, 3]. Favorable economics and possibility of