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Recent advances of high entropy alloys for aerospace applications: A review

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Abstract:
This study aims to review the recent advancements in high entropy alloys (HEAs) called high entropy materials, including high entropy superalloys which are current potential alternatives to nickel superalloys for gas turbine applications. Understandings of the laser surface modification techniques of the HEA are discussed whilst future recommendations and remedies to manufacturing challenges via laser are outlined. Design/methodology/approach. Materials used for high-pressure gas turbine engine applications must be able to withstand severe environmentally induced degradation, mechanical, thermal loads and general extreme conditions caused by hot corrosive gases, high-temperature oxidation and stress. Over the years, Nickel-based superalloys with elevated temperature rupture and creep resistance, excellent lifetime expectancy and solution strengthening L12 and precipitate used for turbine engine applications. However, the superalloy's density, low creep strength, poor thermal conductivity, difficulty in machining and low fatigue resistance demands the innovation of new advanced materials. Findings: HEAs is one of the most frequently investigated advanced materials, attributed to their configurational complexity and properties reported to exceed conventional materials. Thus, owing to their characteristic feature of the high entropy effect, several other materials have emerged to become potential solutions for several functional and structural applications in the aerospace industry. In a previous study, research contributions show that defects are associated with conventional manufacturing processes of HEAs; therefore, this study investigates new advances in the laser-based manufacturing and surface modification techniques of HEA. Research limitations/implications. The AlxCoCrCuFeNi HEA system, particularly the Al0.5CoCrCuFeNi HEA has been extensively studied, attributed to its mechanical and physical properties exceeding that of pure metals for aerospace turbine engine applications and the advances in the fabrication and surface modification processes of the alloy was outlined to show the latest developments focusing only on laser-based manufacturing processing due to its many advantages. Originality/value It is evident that high entropy materials are a potential innovative alternative to conventional superalloys for turbine engine applications via laser additive manufacturing.