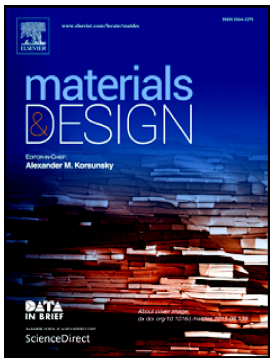

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Optimization of Selective Laser Melting Parameters and Influence of Post Heat Treatment on Microstructure and Mechanical Properties of Maraging Steel

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Abstract

The influences of various process parameters on densification behavior, surface morphology, microstructure, and mechanical properties of selective laser melted (SLMed) maraging steel have been investigated. A process map for the SLM of maraging steel has been constructed. There exists a relatively large processing window, where sound products with relatively high relative density and good surface quality can be obtained. As-built specimens contained martensite matrix with trace amount of austenite phase. The quantity of austenite phase increased during aging treatment due to reversion of martensite to austenite. Solution treatment/aging resulted in elimination of the austenite phase and formation of intermetallic precipitates in the martensite matrix. The as-built and aged specimens exhibited almost the same average grain size, while solution treatment/aging resulted in grain growth of the martensite matrix and a significant change in grain orientation. The results indicated that the SLMed specimens with the building direction parallel to the loading direction had much lower elongation than those with the building direction perpendicular to the loading direction. The maximum tensile strength and hardness obtained were 2033 MPa and 618HV respectively, after solution treatment at 820 ^{0}C for 1 hour and aging at 460 ^{0}C for 5 hours.

Keywords: Additive manufacturing; selective laser melting; maraging steel; microstructure; mechanical properties; energy density