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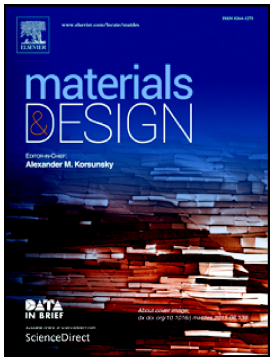

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Oxide dispersion-strengthened alloys generated by laser metal deposition of laser-generated nanoparticle-metal powder composites

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ABSTRACT: A new method is proposed for producing nanoparticle-metal composite powders for laser additive manufacturing of oxide-dispersion strengthened (ODS) alloys. Different composite powders containing laser-generated Y_2O_3 and yttrium iron garnet (YIG) nanoparticles were produced and consolidated by Laser Metal Deposition (LMD). The structural properties of the manufactured ODS alloys were analyzed, and their hardness, remnant porosity, and temperature-dependent compression behavior were characterized to study the effect of the composition and size of the nanoparticles on the structural and mechanical properties. While the structural analyses did not show significant differences between the processed samples within the limits of the characterization methods that were used, the temperature-dependent compression behavior showed an increase of up to 22 ± 11% in the high-temperature strength of the specimens that contained only 0.03 wt% of laser-generated nanoparticles. This increase is attributed to the dispersed and deagglomerated nature of the nanoparticles that were used during the powder-preparation step.

KEYWORDS: Oxide dispersion strengthened steel, Laser additive manufacturing, Laser metal deposition, Laser synthesis of colloids, Nanocomposite powders