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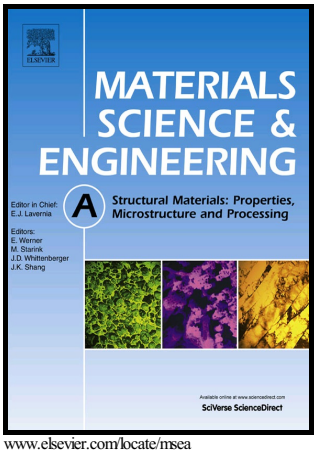


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# Effect of heat treatments on microstructure evolution and mechanical properties of blended Nickel-based superalloys powders fabricated by laser powder deposition

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Abstract: Microstructure evolution and mechanical properties of sample produced by laser powder deposition using blended powders of Mar M247 and Amdry DF3 were studied in the as-deposited and heat treated conditions. In the as-deposited condition, continuous (Cr, W) borides and γ-$Ni_3B$ eutectics were observed to segregate in the interdendritic regions. After the two-step aging treatment, the low melting point γ-$Ni_3B$ eutectics re-melted. Small size γ-γ′ eutectics and discrete W borides formed during re-solidification. The γ′ strengthening phase that precipitated out homogeneously in the dendritic cores had an average diameter of 102±26 nm. When annealing was attempted before the aging treatment, both γ-$Ni_3B$ eutectics and the surrounding dendrites re-melted, contributing to the coarsening of the γ-γ′ eutectics and the discrete W borides. Gamma prime precipitates with average diameter of 106±30 nm were observed. This microstructure evolution from the re-melting of γ-$Ni_3B$ eutectics and development of γ-γ′ eutectics eradicated the risk of strain-age cracks during the two tested heat treatments by backfilling. The coarsening kinetics of γ′ precipitates in the two heat treated conditions was modeled and showed a good agreement with the experimental observation. The microhardness results showed that the as-deposited condition possessed the highest hardness attributed to the continuous feature of the secondary phases, while the two heat treated conditions presented similar hardness owing to the similar size and volume fraction of γ′ precipitates. The tensile test results at both ambient and elevated temperatures indicated that the two types of heat treatments increased the tensile properties, especially ductility.