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Effect of Partial and Full Substitution of Ni with NiB on Densification, Structure and Properties of 90W-6Ni-2Fe-2Co Heavy Alloys

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Abstract

The effect of composition modification by partial and full substitution of Ni with nickel boride (NiB) in 90W-6Ni-2Fe-2Co (wt%) tungsten heavy alloys (WHAs) are evaluated. The total content of (Ni + NiB) is maintained at 6 wt% in all cases. WHAs are consolidated by conventional sintering at three different temperatures of 1410, 1440, and 1470 ˚C in hydrogen atmosphere for 1 h 15 min. Partially and fully substituted NiB samples result in enhanced densification at relatively less sintering temperature (1410 ˚C). A systematic investigation of the effect of NiB substitution on densification, phase evolution, microstructure, mechanical, and thermal properties are presented. In the microstructure of sample, where Ni is fully substituted with NiB; tungsten rich 'channel' or 'interconnects' are observed in between tungsten spheroids irrespective of sintering temperatures. The combination of high sintered density (>99.5 % theoretical), high micro-hardness of the matrix, and low CTE is displayed by partially or fully NiB substituted sample sintered at 1470 ˚C.

Keywords

WHAs; NiB; phase; microstructure; channels/interconnects; CTE

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