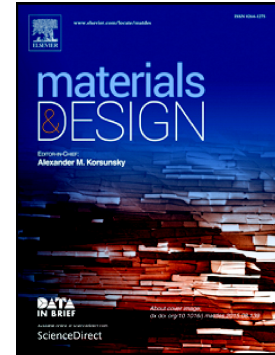


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of Nb-Si based alloys**

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Abstract

The microstructure and room-temperature mechanical properties of directionally solidified and heat-treated Nb-16Si-23Ti-4Cr-2Al-2Hf-0/0.3/0.5Sc (at%) alloys were investigated. All alloys consisted of Nb-based solid solution (Nb_{ss}), α -Nb₅Si₃ and γ -Nb₅Si₃ with preferred <001> orientation for the first two phases, and Sc was enriched in γ -Nb₅Si₃ phase. Sc-added alloys showed a more continuous Nb_{ss} matrix in which the finer Nb₅Si₃ phase distributed uniformly. The volume fraction of both α -Nb₅Si₃ and γ -Nb₅Si₃ phase was decreased by Sc addition. Sc alloying reduced the Young's modulus and nano-hardness of Nb_{ss} phase. 0.50 at% Sc addition enhanced the fracture toughness and tensile strength from 9.88 MPa m^{1/2} and 430.3 MPa to 25.95 MPa m^{1/2} and 1119.7 MPa. The improvement in fracture toughness was due to the better deformability of Nb_{ss} phase. The high tensile strength was attributed to the dispersed and refined Nb₅Si₃ phase, which was not degraded by the increased Nb_{ss} volume fraction since dislocations were not open within most Nb_{ss} phase. Besides, the strong interface cohesion was preferable for the strength of Sc-added alloys.

Keywords: Microstructure; Growth orientation; Young's modulus; Nano-hardness; Fracture

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