POWDER ROUTE PROCESSING OF NB-SILICIDE BASED ALLOYS

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Key Words: Powder Processing, Spark Plasma Sintering.

For reasons of performance and fuel efficiency, aerospace engines of the future are expected to be able to operate at temperatures that are ever closer to and ultimately in excess of the melting temperatures of nickel-based superalloys. Consequently, alloys based on the refractory metal niobium are being investigated as alternatives to nickel-based superalloys. Alloys based on niobium with the addition of silicon show promising high temperature creep and room temperature toughness properties. They are also less dense than nickel-based superalloys. This suggests that they could, with development, meet the needs of future ultra-high temperature aerospace engine applications.

To date, most of the published research has concentrated on cast and heat treated alloys. Powder route processing offers the potential for the manufacture of near net shape components but has attracted less attention in the open literature. This is probably due to the sluggish kinetics in Nb-Si based alloys, the sensitivity of Nb to contamination by interstitials and the availability of powders.

This presentation will concentrate on powder route processing of model Nb-silicide alloys using elemental and pre-alloyed powders and plasma spark sintering or additive layer manufacturing. The microstructures produced by each processing method will be compared to ascertain the influence of processing route on microstructure. Emphasis will be given to phase selection and phase transformations and the contamination of the microstructure by interstitials during processing.