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Mo Silicide Alloys for High Temperature Applications

Diskussionsleitung: Prof. Dr. M. Heilmaier

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Abstract

The challenges of a high temperature environment impose severe material performance constraints in terms of melting point, oxidation resistance and structural functionality. While Ni base superalloys have provided exceptional performance in gas turbine engines at temperatures up to about 90% of their melting temperature, they have reached a limit where a major increase in operating temperature is not feasible. However, refractory metal alloys such as the Mo silicides with melting temperatures well above 2000°C and multiphase microstructures involving a Mo solid solution and intermetallic phases that allow for superior creep strength, in-situ toughening and some oxidation resistance offer an attractive option for increased temperature applications. In order to establish some of the key alloy fundamentals, the phase equilibria, the diffusion behavior and the influence of selected alloying are being examined systematically. Since the alloy compositions that exhibit optimum mechanical property performance will most likely not yield the lowest oxidation rate, it is important to develop robust and compatible oxidation resistant coatings. An effective strategy to address this challenge is based upon in-situ reaction processing and kinetic biasing to develop coating systems that are thermodynamically compatible with the base alloy and also incorporate an inherent capability for repair. The coating design is applied by a pack cementation process. With coated samples the environmental resistance can be enhanced up to at least 1700°C. Moreover, the coating strategy can be adapted to apply to other refractory metal systems to provide excellent high temperature environmental resistance.