Microstructure and Mechanical Properties of $MoSi_2$ at High Temperature

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Abstract

Over the past twenty years, researchers have studied many alloy systems and processing routes to select potential intermetallic compound for applications at high temperature. $MoSi_2$ is one of the most promising intermetallic compounds for high temperature applications due to its very high melting point, low density and outstanding oxidation resistance. Recent attempts have been concentrated on the development of $MoSi_2$ composites in order to overcome the problems of monolithic $MoSi_2$. Alloying is one of the most widely adopted methodologies to improve the mechanical properties of intermetallic compound. In this study, mechanical alloying and pulse discharge sintering process was employed to fabricate $MoSi_2$ alloys with two different $MoSi_2$ grain size (1micron and 10micron). The tensile properties of two $MoSi_2$ alloys were evaluated in vacuum at temperatures ranging from 1400 to 1600K and initial strain rates ranging from 1×10^{-5}/s to 1×1^{-3}/s. For the alloy with 10 micron grain size an m value of 0.35 and an activation energy value of 350 kJ/mol were observed in the lower strain rate range while an m value of 0.12 and an activation energy value of 760 kJ/mol were observed in the higher strain rate range. For the alloy with 1 micron grain size, a uniform m value of 0.55 and an activation energy value of 160 kJ/mol were observed. Moreover these two alloys showed remarkable ductility (maximum 33%) in the test temperature. The aim of this paper is to evaluate the high temperature tensile properties of the $MoSi_2$ alloy and to understand its deformation mechanism and microstructural characterization.