MICROSTRUCTURAL ANALYSIS AND HIGH TEMPERATURE CREEP OF Mo-9Si-8B ALLOYS WITH Al AND Ge ADDITIONS

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Refractory metals and their alloys show potential for high temperature applications, due to the increased melting point and creep resistance. Spark plasma sintering technology as well as argon arc melting is used to prepare quaternary and quinternary Mo-9Si-8B-xAl-yGe (x is 0 or 2; y is 0 or 2) samples. Compositions are stated in at.%. All the compositions consist of a Mo solid solution (α-Mo) and two intermetallic phases: Mo_3Si (A15) and Mo_5SiB_2 (T_2). On the one hand, no zirconium is added to the alloys to avoid evaporation of MoO_3 due to the phase transformation from a monoclinic to a tetragonal crystallographic structure of ZrO_2 at 1150°C. On the other hand, fractions of Al and Ge are alloyed to reduce the melting point of the intermetallic phases. The specimens are homogenized and coarsened by a subsequent heat treatment in a vacuum radiation furnace at 1850°C for 24 h. Both the reduction of the melting point and the heat treatment at a temperature of 1850°C result in an increase in diffusion rate. This procedure is expected to generate an α-Mo interpenetrating network. The resulting microstructures are investigated using SEM, EDX and XRD analyses. A creep testing device for a very short specimen heated in a radiation furnance up to 1400°C usable in air or vacuum is presented. Creep tests are performed at elevated temperatures in vacuum to investigate the influence of different fabrication techniques.

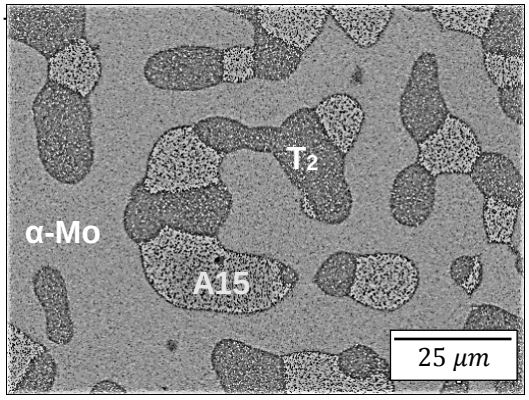

Figure 1 – EDX-Analysis of an arc melted Mo-9Si-8B-2Al-2Ge ingot after heat treatment