Mechanical properties of ternary eutectic V-9Si-6.5B

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The V-Si-B system has gained scientific interest as a new low-density, refractory metal-based structural intermetallic alloy system. The alloy design is strongly influenced and driven by the developments in the field of Mo-Si-B alloys and shares some interesting structural and microstructural features. Very recently, the formations of ternary eutectic V_{SS}-V_3Si-V_5SiB_2 microstructure has been reported [1] which contains the same isomorphous phases as the ternary eutectic in the well-studied Mo-Si-B system: a refractory metal-based solid-solution phase (Mo_{SS} or V_{SS}) and the two intermetallic phases with either an A15 (Mo_3Si and V_3Si) or a $D8_l$ (Mo_5SiB_2 and V_5SiB_2) structure. In contrast to the Mo-based system, where the intermetallic Mo_3Si represents the major phase within the ternary eutectic microstructure, the V_{SS}-V_3Si-V_5SiB_2 eutectic features the ductile solid-solution phase as the major component. This fact makes the V-Si-B ternary eutectic very interesting in terms of its mechanical properties.

The present work is focused on the compressive stress-strain behavior of the ternary eutectic alloy composition V-9Si-6.5B. Compression tests were performed using an electro-mechanical universal testing machine and a constant crosshead speed corresponding to an initial (engineering) strain rate of 10^{-3} s^{-1}. The yield stresses were determined by the 0.2% offset method. The temperature dependence of its yield stress was investigated in the as-cast and annealed state (1400 °C for 100 hrs) of the alloy V-9Si-6.5B. Both conditions were tested between room temperature and 1000 °C and were compared to literature values of different V-based alloys [2–4].

References

[1] W.G. Yang, G. Hasemann, M. Yazlak, B. Gorr, R. Schwaiger, M. Krüger, J. Alloys Compd. 902 (2022) 163722.

[2] H. Bei, E.P. George, E.A. Kenik, G.M. Pharr, Z. Met. 95 (2004) 505–512.

[3] S. Xie, E.P. George, MRS Proc. 980 (2007) 0980-II08-05.

[4] M. Krüger, Scr. Mater. 121 (2016) 75–78.