Density Measurement of Ti-Mo Melt Using Electromagnetic Levitation Technique

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Ti-based alloys are widely used for medical implant production due to their high biocompatibility. Ti-Mo alloys exhibit lower elasticity compared with pure Ti [1], therefore, the Ti-Mo alloys are expected to be used for artificial joint material because it leads to reduction of mismatch between the elasticity of bone and implant. Additive manufacturing is attracting attention in the biomaterials field because of its ability to produce a wide variety of products in small quantities. In the additive manufacturing, a large gradient exists in the vicinity of laser or electron beam irradiation area, thus, local high temperature zones and deeply undercooled zones are formed in the melt pool. To improve the additive manufacturing technique, it is necessary to understand the melting and solidification processes at the interface between solid and the melt pool. To analyze the melitng and solidification processes, thermophysical properties of molten materials over a wide temperature range and their temperature dependence are required. In this study, the density of the Ti-Mo melt was measured using the electromagnetic levitation (EML) technique in a static magnetic field [2] at temperatures ranging from 1900 to 2330 K. The density of the Ti-Mo melt decreased with increasing temperature linearly in the temperature range of this experiment. The measurement results show that the density of the Ti-Mo melt increases with increasing Mo composition. The molar volume of the Ti-Mo melt agreed within uncertainty with the molar volume calculated by the ideal solution model from the molar volume of pure Ti and Mo.

References

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2. M. Watanabe, et al.: J. Mater. Sci., 52 (2017) 9850-9858.