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Chemical Stability of Ceramic Crucibles to Molten Titanium

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Abstract : Titanium is widely used due to its high specific strength, good biocompatibility, and excellent corrosion resistance. In order to produce titanium powders, it is necessary to melt titanium, and generally it is conducted by an induction heating method using Al_2O_3 ceramic crucible. However, since titanium reacts chemically with Al_2O_3, it is difficult to melt titanium by the induction heating method using Al_2O_3 crucible. To avoid this problem, we studied the chemical stability of the various crucibles such as Al_2O_3, MgO, ZrO_2, and Y_2O_3 crucibles to molten titanium. After titanium lumps (Grade 2, O(oxygen)<0.25wt%) were placed in each crucible, they were heated to 1800℃ with a heating rate of 5 ℃/min, held at 1800℃ for 30 min, and finally cooled to room temperature with a cooling rate of 5 ℃/min. All heat treatments were carried out in high purity Ar atmosphere. To evaluate the chemical stability, thermodynamic data such as Ellingham diagram were utilized, and also Vickers hardness test, microstructure analysis, and EPMA quantitative analysis were performed. As a result, Al_2O_3, MgO and ZrO_2 crucibles chemically reacted with molten titanium, but Y_2O_3 crucible rarely reacted with it.

Keywords : titanium, induction melting, crucible, chemical stability
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