Alexander von Humboldt
Stiftung/Foundation

Abstracts

Einführungstagung
Bonn
19.-21. April 2005

Brücken für die

Forschung

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Fachgebiet:
Metallurgie

Keywords:
alloy, concentration, crucible oxide, thermodynamic, titanium

Thermodynamic Stability of Crucible Oxides in Molten Titanium and Titanium Alloys

Titanium and its alloys interstitially dissolve a large amount of impurities such as oxygen and nitrogen, which degrade the mechanical and physical properties of alloys. Ways of eliminating oxygen from titanium and its alloys are important for use in widespread applications. On the other hand, crucible oxides i.e. refractory oxides based on CaO, ZrO_2, Y_2O_3, and their spinels, can be used for melting the refractory metals such as titanium, zirconium and niobium and their alloys.
However, the thermodynamic behavior of calcium, zirconium, yttrium on the one side, and oxygen on the other side, in molten Ti and Ti-Al alloys have not been made clear. Because of that, the thermodynamic analysis in Ca(Zr,Y)-Ti-Al-O systems in accordance to determine the crucible oxide stability in molten titanium and titanium-aluminum alloys is researched. The thermodynamic calculations of the activity and Gibbs free energy of the most important crucible oxides (CaO, ZrO_2, Y_2O_3) in molten titanium and titanium-aluminum alloys as function of temperature and composition are also investigated.