Estimation of Solid-liquid Interfacial Energies of Alloy Systems from Thermodynamic Properties

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Abstract

Evaluation of interfacial energies is important for the understanding of various kinds of interfacial phenomena. Since the interfacial energy between solid and liquid phases is one of important physical properties to analyze the solidification of metals and alloys, there have been many reports on the interfacial energy of pure metals from experimental and theoretical view. However, there is not enough information on the solid-liquid interfacial energy for alloy systems, especially ferrous alloys.

In the present study, solid-liquid interfacial energies are estimated for alloy systems based on thermodynamic properties such as enthalpy and entropy of fusion for alloy components, as well as the ratio of coordination numbers between bulk and interface, which depends on crystal structure and its crystal planes of solid phase. The latest thermodynamic databases for alloy systems are used for the evaluation of thermodynamic properties. Calculated solid-liquid interfacial energies for pure metals and some alloys are in good agreements with existing experimental data. Furthermore, composition dependences of solid-liquid interfacial energy are discussed for several binary alloy systems.