Wetting Transitions in Binary Subregular Liquid Alloys

C. Antion
Laboratoire d'Instrumentation et de Matériaux d'Annecy (LAIMAN), ESIA, Annecy Cedex, France

D. Chatain[C,S]
Centre de Recherche en Matière Condensée et Nanosciences (CRMCN), CNRS, Marseille, France
chatain@crmcn.univ-mrs.fr

Sub-regular models of surface segregation and of interface composition profiles have been developed in order to examine the behavior of surface and interfacial energies in binary liquid alloy systems which exhibit wetting and prewetting transitions. The calculations performed using four parameters fitted to macroscopic quantities are consistent with many of the major characteristics expected of these transitions. As two-phase coexistence is approached from the domain of stability of the wetted phase, at temperatures above the wetting transition temperature, the wetting phase forms at the surface of the wetted phase by a series of layering transitions, and its thickness is found to diverge logarithmically. Under conditions of two-liquid phase equilibrium, the surface energies of the two liquids and the energy of the interface separating the two liquids are found to strictly satisfy the condition of perfect wetting. The effect of asymmetry of the bulk miscibility gap on the wetting transition is analyzed by comparing the calculations performed with this model in a subregular solution with the one done in a regular solution model. Predictions of the model are found to be in good agreement with previous measurements of the surface energy of liquid Ga-Pb and Co-Cu alloys as a function of bulk composition.