Surface Properties and Concentration Fluctuations in Sn-based Molten Alloys

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A simple model based on the concept of a layered structure near the interface has been used to investigate the surface tension and surface segregation of SnPb and SnZn molten alloys. With increasing concentration of Sn, the surface tension (σ) of SnPb alloys has been found to increase, while σ of SnZn alloys decreases. σ of both systems is smaller than the ideal value $\Sigma C_i\ \sigma_i$. Our study reveals that both in SnPb and SnZn alloys the heavier atoms segregate towards the surface. The degree of segregation in SnZn alloys is greater than that in SnPb alloys. The Cahn-Hillard phenomenological model for the surface of pure liquids has been extended to binary molten mixtures and applied to the above systems. An attempt has been made to establish a link between the surface tension and the bulk properties such as concentration fluctuations in the long wavelength limit [$S_{CC}(0)$] and isothermal compressibility (χ_T). The impact of the very sensitive bulk parameter $S_{CC}(0)$ has been examined. Reasonable agreement between our model and the experiment is observed for binary molten alloys such as SnPb in which the segregation is small, while for the SnZn alloys, in which the segregation is quite large, the agreement is not satisfactory.

Key words: Surface Tension; Surface Segregation; Sn-based Alloys; Concentration Fluctuations; Order Potential.