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Segregation measurements of In and S on a Cu(In,S) ternary alloy using Auger Electron Spectroscopy coupled with a linear programmed heater

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Abstract content
 (Max 300 words)

Segregation is playing a very significant role during heat treatments to engineer the composition and properties of grain boundaries and surfaces of a crystal [1]. There is large number of segregation studies on the segregation of impurities from Cu [2–6]. Despite the considerable number of publication concerning segregation of impurities from a Cu crystal, no study was found for In segregating from a Cu crystal. Therefore, this study is most likely the first to report on the segregation of In from a Cu crystal. In this study a dilute Cu(In,S) ternary alloy was prepared by diffusion doping. The segregation behaviour of In and S was measured using Auger Electron Spectroscopy (AES) coupled with a linear programmed heater. From the measured segregation profiles it was found that the In segregated first followed by S. The S completely replaced the In from the surface indicating that S has a larger segregation energy than In. From the segregation profiles the segregation parameters, namely the pre-exponential factor (D_0), the activation energy (Q), the interaction energies (Ω) and the segregation energies (ΔG) were extracted with the modified Darken model for In ($D_0 = 2.2 \pm 0.5 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$, $Q = 184.3 \pm 1.0 \text{ kJ mol}^{-1}$, $\Delta G = -62.8 \pm 1.4 \text{ kJ mol}^{-1}$, $\Omega_{\text{Cu-In}} = 3.0 \pm 0.4 \text{ kJ mol}^{-1}$) and S ($D_0 = 8.8 \pm 0.5 \times 10^{-3} \text{ m}^2 \text{ s}^{-1}$, $Q = 213.0 \pm 3.0 \text{ kJ mol}^{-1}$, $\Delta G = -120.0 \pm 3.5 \text{ kJ mol}^{-1}$, $\Omega_{\text{Cu-S}} = 23.0 \pm 2.0 \text{ kJ mol}^{-1}$). The interaction energy for In and S was $\Omega_{\text{In-S}} = -4.0 \pm 0.5 \text{ kJ mol}^{-1}$.

References

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