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AES and TOF-SIMS measurements of In segregation in a polycrystalline Cu crystal

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Abstract content
   (Max 300 words)

Lately, Cu-In system receives attention particularly for applications in solar cells, thin-film transistor liquid-crystal display, ultra-large-scale integrated devices¹⁻³. But studies on In segregating from the bulk to the surface and grain boundaries of a Cu crystal are not available in literature. In this study, the focus is on measuring the bulk-to-surface and boundary segregation of In in a polycrystalline Cu crystal using Auger Electron Spectroscopy (AES) and time-of-flight secondary ion mass spectrometry (TOF-SIMS) coupled with a programmable heater. AES measurements were carried out using constant temperatures in the temperature range 733 K to 853 K. The measured AES data showed that In segregate to the surface and it has reached a relative high surface concentration on the Cu surface. The AES In segregation data was fitted with the semi-infinite model of Fick to obtain the In bulk diffusion parameters (D₀ = 1.1 × 10⁻⁵ m² s⁻¹, Q = 191.9 kJ mol⁻¹). The AES segregation measurements were performed in the middle of a grain on the surface. The average grain size was 112 μm which is much larger than the primary electron beam (13 μm). However, these measurements could be affected by the surface orientation of the different grains. The effect that the surface orientation of the grains has on the In segregation was obtained with TOF-SIMS measurements (carried out using the linear temperatures method). The TOF-SIMS segregation data from two twin grains showed equal segregation rates, which is expected since the twin grains have the same surface orientation. However, segregation data from two different grains showed different segregation rates which confirm the effect surface orientation has on segregation.

References
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J.J. Terblans (terblansjj@ufs.ac.za)
University of the Free State

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Primary author: Mr MADITO, Moshawe (University of the Free State)

Co-authors: Prof. SWART, Hendrik (University of the Free State); Prof. TERBLANS, Koos (University of the Free State)

Presenter: Mr MADITO, Moshawe (University of the Free State)

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