MSE SEMINAR

Materials Science and Engineering
Michigan Technological University

Tuesday, April 16, 2013
11:00 am – 12:00 pm
Room 610, M&M Building

Graduate Student Presentations

Ternary Diffusion Interactions in Dilute Aluminum Scandium Zirconium Alloys

Marcel Kerkove
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Abstract

The proposed study will use semi-infinite diffusion couples to obtain ternary diffusion coefficients for scandium and zirconium in aluminum. Al with Sc additions has potential as a high temperature precipitation hardened alloy due to the formation of stable Al3Sc precipitates. Due to the cost of Sc and potential for improved coarsening resistance, other rare earth elements such as Zr have been investigated as substitutes for some of the Sc. However, current research does not include determination of ternary diffusion coefficients for Sc and Zr in Al. It is hypothesized that some of the observed coarsening resistance can be attributed to Sc-Zr interactions within the α Al solid solution phase. Semi-infinite diffusion couples will be constructed from dilute alloys such that they form an Al-Sc-Zr solid solution. After annealing, diffusion coefficients will be extracted from concentration profiles measured using wavelength dispersive spectroscopy. Obtaining the ternary diffusion coefficients and understanding of Sc-Zr interactions will be important in Al-Sc-Zr alloy processing.

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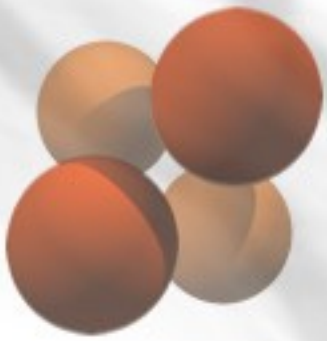

Graded Band Gap $In_xGa_{1-x}N$ Nanowire Array for p-i-n Junction Solar Cells

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Abstract

In this proposal we aim at constructing a novel structured InGaN p-i-n junction solar cell. Nanowire array geometry is employed to achieve the goal due to its advantages over conventional planar design in l harvesting and energy conversion processes. To maximize the cell's absorption, graded band gap InGaN nanowire is applied as comparison to the InGaN nanowire solar cell with fixed band gap. Preliminary modeling of radiation energy loss shows more than 350W/m2 is utilized when adopting ideal graded band gap model compared to single junction cell, which contribute to 35% of total solar radiation energy. Experiment on nanowire synthesis and device fabrication with step by step control is then designed and discussed. Anticipated results and further improvement are included.

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