Advanced Quantitative Transmission Electron Microscopy of Semiconductor Nanowires for Solar Cell Applications

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Abstract

Semiconductor nanowires are of great interest for multiple applications, including solar cell heterostructures. However, accurate and quantitative characterization of nanoscale structures requires techniques such as transmission electron microscopy (TEM). In this work, we take several examples of quantitative TEM acquisition and analysis on semiconductor nanowires from an EU-funded solar-cell development project, AMON-RA.

In the first example, Au-catalyzed GaAs nanowires are heated in situ in the TEM, and they are found to dissolve along the Au-GaAs interface. While this behavior has been noted before [1], it has not been extensively characterized. This process provides potentially useful information, as they are grown at elevated temperatures near the temperature used for the in situ dissolution. The rate of this dissolution process depends on several factors, such as temperature, but also electron beam characteristics, requiring more than just quantification of the dissolution process itself, but also a full understanding of the characterization techniques applied to it. If this dissolution behavior were to be fully characterized, the transport mechanisms of Ga and As through or around the Au would potentially be clarified.

References:
[1]: Persson et al. **Nature Materials** (2004) vol. 3 (10) pp. 677-681.