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High Temperature XRD *in-situ* Characterization of Processing of CuInSe₂ Photovoltaic Thin Films.

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Thin film samples fabricated on optically flat substrates provide convenient sample geometry for conventional Bragg-Brentano X-ray diffraction analysis. Such samples can usually be easily mounted in most commercial high-temperature attachments, although care must be taken in temperature measurement and control. We present three examples illustrating the value of time-resolved high-temperature x-ray diffraction data for characterization of film crystallization, nucleation and growth, phase transformations and texture development, and the challenges for data interpretation and analysis arising primarily from orientation texture and film thickness.

Copper indium diselenide "CIS" is a very efficient photovoltaic material, fabricated as a thin film on glass substrates with a molybdenum buffer layer. Minimizing the production steps and keeping the processing temperatures as low as possible are essential to the commercialization of these films. To this end, several precursor chemistries and structures have been investigated, including the deposition of CuSe and InSe bilayer precursors with subsequent thermal processing. In this instance the reaction plane acts as a diffusion barrier, significantly altering the kinetics of CIS film growth compared to other precursor geometries.

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