

## Shedding New Light on Advanced Materials

Matthew J. Kramer, Alan Goldman and R. William McCallum,

A unique, compact furnace combined with synchrotron radiation at the APS makes it possible for the first time to directly record a material's chemical and structural changes at high-temperatures under real processing conditions. This phase-change information, crucial to understanding and controlling the composition and microstructure of new materials, previously took months or years to collect. The furnace is based in the newly commissioned MUCAT sector at the Advanced Photon Source. By combining the brightness of the third-generation synchrotron source with the precise temperature control of the new furnace, this essential information can be gathered in just a few days while giving a more detailed picture of what happens to crystal structures during the phase changes. The furnace allows X-ray diffraction measurements to be performed at temperatures of up to 1500°C under flexible environments (including inert and variable partial pressures of oxidizing or reducing gases), duplicating the parameters used in materials processing. The reactions are monitored with a time resolution of less than two seconds. Getting faster, more accurate information may speed up the development of several high-temperature materials, including structural ceramics, superconducting wires and nanostructured materials.

