

W0203

Multi-component Characterization of Commercial Ceramics and Metal Alloys by Anomalous USAXS. Pete R. Jemian*, Gabrielle G. Long, Rosario A. Gerhardt, Sheldon M. Wiederhorn, Frantisek Lofaj, Jan Ilavsky, *Materials Research Laboratory, Univ. of Illinois at Urbana-Champaign, UNICAT Bldg. 438D, Argonne, IL 60439.

Ultra-small-angle X-ray scattering (USAXS) provides quantitative and statistically significant information about the size distribution of inhomogeneities in materials. When more than one type of inhomogeneity is present and these inhomogeneities are similarly sized, it is difficult to separate the populations. Anomalous USAXS (A-USAXS) offers an opportunity to vary the contrast of individual populations enriched (or depleted) in the anomalous element, and obtain quantitative results on each population.

Two current examples will be used to illustrate the power of A-USAXS to extract detailed, quantitative information about the microstructure of each component in multi-component commercial materials. One study examines the secondary precipitate population that evolves in high-temperature nickel-base superalloys during long-term thermal exposure such as would be experienced in-service by aircraft engine turbine blades. In the second study, control of creep cavitation in silicon nitride high-temperature ceramics is investigated by observing the populations of secondary phases and cavities.

Descriptions will be given of these experiments which made use of USAXS instruments with excellent energy-resolution, established methods for collimation correction and size distribution determination, and a scattering contrast gradient method for extracting the contributions due to anomalous scattering.