3-D TOMOGRAPHIC STUDIES OF ANNEALED NANOPOROUS GOLD USING TRANSMISSION X-RAY MICROSCOPE (TXM) AT ADVANCED PHOTON SOURCE

Yu-chen Karen Chen[1,2], Yong Chu[2], Jaemock Yi[2], Marie Cox[1], David C. Dunand[1] and Qun Shen[1,2]

1. Department of Materials Science and Engineering, Northwestern University, Evanston, IL 60208
2. Advanced Photon Source, Argonne National Laboratory, Argonne, IL 60439

Three dimensional tomography has become a powerful tool on studying the internal structure of various materials and hence acquiring quantitative 3-D information. X-ray imaging is ideal for tomography for it is nondestructive analysis. The study on porous materials, with complicated 3-D structure, has benefited from advanced X-ray 3-D tomography technique.

Nanoporous metals display novel physical, chemical and mechanical properties, accompanied with potential applications in such diverse areas as catalysis, heat exchange, mechanical actuation, and sensors. Especially, nanoporous gold is scientifically intriguing and significant because of the complex 3-D structure formations and evolutions, which are not fully understood. We developed nanoporous gold foam by dealloying Ag-Au alloys. Nanoporous gold was annealed on different temperature to acquire different pores scales.

By using transmission x-ray microscope 3-D tomography techniques, we have observed the internal 3-D porous cavities at a few hundred nanometers. The transmission x-ray microscope at the Argonne National Laboratory has demonstrated a 2-D resolution down to 40 nm. In addition, the synchrotron x-ray source is crucial because of its high-intensity hard x-ray beams to penetrate the whole sample object and also the high-flux to obtain imaging data within reasonable time scale. This tomography information will be critical to quantitative analysis on the structure formation. We propose to establish analysis method for imaging porous nano-materials to correlate the process, structure and properties. We also plan to design *in-situ* imaging experiments to directly follow the nanoporous structure evolution as a function of time.

Acknowledgement: Use of the Advanced Photon Source was supported by the U. S. Department of Energy, Office of Science, Office of Basic Energy Sciences, under Contract No. DE-AC02-06CH11357.