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Structure and Phase Separation in Ultrathin Ag/Cu Amorphous Alloy System. Hao Chen, J.M. Zuo, Dept of Materials Sci. & Eng., Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801.

The goal of the project described here is to combine electron diffraction for structure characterization with the chemical sensitivity of Z-contrast imaging of amorphous thin metal films. The structure of disordered metallic alloys is an important but unsolved problem. Previous studies on Ag-Cu system showed that relatively homogeneous solid solutions formed at liquid nitrogen temperature decompose into separate phases or evolve into crystalline structure at a higher temperature.

In this research project, we prepared ultra-thin Ag-Cu films on amorphous carbon support by HV magnetron sputtering using both targets. With high deposition rate of Ag and Cu atoms onto the carbon substrate, a fast cooling rate is achieved. Ag and Cu are forced to form amorphous alloy or nano-crystalline thin film at room temperature.

We have investigated the structure of ultra-thin Ag-Cu films by examining their pair distribution function (PDF) using electron diffraction and observed phase separation process directly in STEM images. In the STEM Z-contrast images, since the contrast is directly related to the atomic number (Z) of the components, we can see clearly the phase separation process. Experimental results show that the sample morphology evolutions are different in samples with different thickness, and the phase separation depends on various Ag/Cu atomic ratios. In $Ag_{50}Cu_{50}$ sample, early stage phase separation is associated with increasing Cu crystallite size, indicates that Cu diffuse out of Ag-Cu solid solution phase.