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The Kirkendall Effect in Copper Nanocrystals MARK STOYKOVICH, KATHERINE RICE, Department of Chemical and Biological Engineering, University of Colorado - Boulder, DEPARTMENT OF CHEMICAL AND BIOLOGICAL ENGINEERING, UNIVERSITY OF COLORADO - BOULDER TEAM — The study of copper nanocrystals, unlike nanocrystals of other noble metals such as gold and silver, has been limited due to challenges in the synthesis of monodisperse copper nanoparticles and their reactivity at ambient conditions. Copper is a material of broad interest, however, because of its unique optical and catalytic properties, as well as its non-toxic nature and relative abundance. Copper nanocrystals in the process of being oxidized are subject to the Kirkendall effect, which describes independent diffusion rates in a binary system (Cu and oxygen in this case) and that causes the formation of voids at the core of spherical nanocrystals. Previous studies have attributed the Kirkendall effect in Cu/Cu2O nanocrystals to interactions between the organic passivation layer and the solvent. Here we will present our results on the kinetics of oxidation of Cu nanocrystals in solvent-less conditions as a function of temperature and show that void formation occurs at a relatively narrow range of temperatures. In-situ UV-vis spectroscopy, x-ray diffraction, and electron microscopy have been used to monitor the oxidation process in Cu nanocrystals and a model has been developed to describe hollow particle formation in the Cu/Cu2O system.

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