IN-SITU USAXS/SAXS INVESTIGATION OF TUNABLE STRUCTURAL COLOR IN AMORPHOUS PHOTONIC CRYSTALS DURING ELECTROPHORETIC DEPOSITION.

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Amorphous photonic crystals (APCs) formed via electrophoretic deposition (EPD) exhibit non-iridescent, angle-independent, structural colors believed to arise from changes in the particle-particle interactions and inter-particle spacing, representing a potential new paradigm for display technologies. However, inter-particle dynamics on nanometer length scales that govern (and enable control over) the displayed color, crystallinity, and other characteristics of the photonic structures, are not well understood. Unfortunately, typical lab-based characterization techniques such as SEM, TEM, and Computed Tomography (CT) are generally performed *ex-situ* once the sample deposit has been dried. In this work, *in-situ* USAXS/SAXS/WAXS studies of three-dimensional colloidal particle arrays (of varying particle size and concentration) were performed in order to identify their structural response to applied external electric fields. This data was compared to simultaneously acquired UV-Vis spectra to tie the overall electrically induced structure of the APCs directly to the observed changes in visible color. The structural evolution of the APCs provides new information regarding the correlation between nano-scale particle-particle interactions and the corresponding optical response. To our knowledge, there has been no other prior studies examining the structure of APCs during the application of an electric field. This novel, *in-situ* USAXS study has helped to gain a better fundamental understanding of how the properties of APCs can be controlled for the advancement of optical displays.

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