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ACCELERATOR-BASED STRUCTURAL INVESTIGATION OF SEMICONDUCTOR NANOCRYSTALS

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ABSTRACT

This study employs synchrotron-based X-ray absorption spectroscopy (XAFS) to resolve the local elemental arrangements and interfacial bonding within complex colloidal semiconductor heterostructures. By performing multi-edge measurements, we systematically map the atomic distribution across internal boundaries as structural complexity increases.Through coordinated analysis of X-ray absorption near edge structure (XANES) and extended X-ray absorption fine structure (EXAFS) data, we determine critical structural parameters, including interatomic distances (R), coordination numbers (N) and Debye-Waller factors (σ^2). Our results provide evidence of a material gradient at the internal interfaces, revealing that the prevailing interatomic bonds are highly sensitive to the size of the initial core. Furthermore, we address the temporal stability of these systems under ambient conditions. Long-term spectroscopic monitoring over long periods of time indicates that while the internal core remains structurally robust, surface-related bonds undergo partial degradation and atomic reorganization. This research represents a comprehensive experimental assessment of the local atomic order in incrementally heterogeneous quantum-confined systems. The findings offer fundamental insights into how precise elemental arrangements at the nanoscale dictate the electronic and emissive properties of advanced semiconductor materials.

***K*eywords** Synchrothron · XAFS · Colloidal semiconductors

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