Engineering X-ray Visibility in Soft Colloids: Iodine-Loaded PISA Nanoparticles

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Polymeric nanoparticles are attractive colloidal building blocks due to their tunable size, surface chemistry, and deformability. However, characterization by X-ray scattering and imaging techniques is often challenged by the low intrinsic contrast of organic soft matter systems. [1] Here, we present a strategy to engineer X-ray-visible soft colloids through incorporation of iodine-containing hydrophobic components into polymer nanoparticles prepared by aqueous polymerization-induced self-assembly (PISA).

The PISA approach enables scalable synthesis of colloidally stable nanoparticles with controlled dimensions and narrow size distributions while maintaining surfactant-free, well-defined interfaces. [2] By varying formulation parameters, the iodine loading can be tuned independently of particle size, providing adjustable X-ray attenuation and scattering contrast. Initial studies demonstrate enhanced detectability of the particles in multicomponent systems and improved contrast in scattering-based measurements.

These iodine-loaded nanoparticles constitute a versatile platform for contrast-matched and contrast-enhanced studies of colloidal interactions, transport phenomena, and structural dynamics in complex soft materials. The concept also offers opportunities for characterization of bio-based and hierarchical materials where conventional contrast is insufficient.

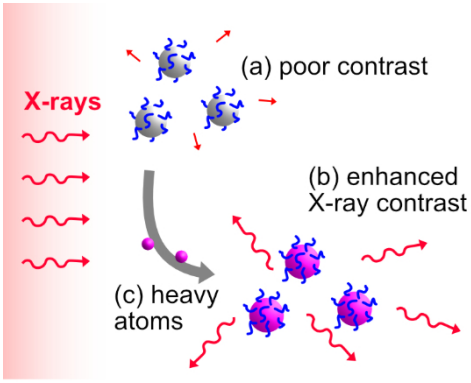

Figure 1. (a) Current colloidal nanoparticles provide poor X-ray contrast. (b) This project will develop a platform of enhanced-contrast nanoparticles by (c) the incorporation of heavy atoms.

References:

[1] Fairclough, J. P. A., et al. (1999). "X-ray scattering in polymers and micelles." Radiation Physics and Chemistry 56(1): 159-173.

[2] D'Agosto, F., et al. (2020). "RAFT-Mediated Polymerization-Induced Self-Assembly." Angewandte Chemie International Edition 59(22): 8368-8392.