

Electrolyte-Driven Nanoparticle Phase Transitions

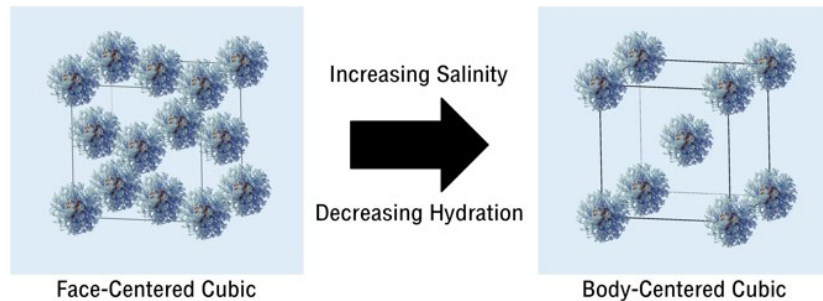


Illustration of the structural phase transition exhibited by DNA-NPs assembled at different CaCl_2 concentrations, as deduced from synchrotron SAXS measurements.

R. J. Reinertsen, F. Jimenez-Angeles, S. Kewalramani, M. Bedzyk, M. Olvera de la Cruz, "Transformations in crystals of DNA-functionalized nanoparticles by electrolytes" *Faraday Discussions* 249, 408-423 (2024); DOI: 10.1039/D3FD00109A

Work was performed at Beamline 5-ID-D of the Advanced Photon Source of Argonne National Lab.

Scientific Achievement

Added salt is shown to influence assemblies of nanoparticles through both electrostatic and dehydration mechanisms.

Significance and Impact

Interactions of charged nanostructures with electrolytes are important for stimuli-responsive materials. Here, non-base-pairing DNA-coated particles exhibit salinity-dependent phase transitions due to changes in the DNA solvation shells.

Research Details

- Non-base-pairing DNA-coated gold nanoparticles assemble into colloidal crystals with added CaCl_2 .
- Small-angle X-ray scattering measurements show that the DNA-NP lattices change from Face-centered cubic to body-centered cubic structures with increasing salinity.
- All-atom molecular dynamics simulations demonstrate that this transition arises from salt-induced disruption of the DNA hydration shells.