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Intermolecular coupling and dynamics through infrared nanospectroscopic imaging BENJAMIN POLLARD, ERIC A. MULLER, OMAR KHATIB, MARKUS B. RASCHKE, Univ. of Colorado - Boulder — Intermolecular interactions and coupling on the nanoscale lead to a variety of structural phases and degrees of crystallinity in soft-matter and biological systems, producing unique functional properties. We combine multi-spectral vibrational scattering-scanning near-field optical microscopy (s-SNOM) with multimodal scanning probe imaging to investigate structure-function relationships in soft matter. Using vibrational resonances as sensitive reporters of local structure, coupling, and dynamics, we resolve spectral shifts and line broadening on the nanoscale. These spectral shifts allow us to map intermolecular electric fields across nanoscale domains through solvatochromism or transition dipole coupling. Similarly, linewidths relate directly to the spatially-varying coupling dynamics of vibrational oscillators. Comparing spectral maps of peak position and linewidth to maps of adhesion and Young's modulus, for example, provides insight into the structure-function relationship dictating nanoscale self assembly in, e.g., block copolymer thin films.

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