

Spectroscopic near-field microscopy of biominerals in the phonon region

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Spectroscopic near-field imaging is enabled by combining a coherent mid-infrared continuum source with 20nm-resolving tip-scattering near-field microscopy (s-SNOM). Broadband amplitude and phase spectra are acquired together with topographical height at every pixel while scanning. As a first application we present studies of biological nanocomposites, namely mollusc shell and human bone specimens which contain mineral nanocrystals in organic matrices. The mineral parts exhibit strongly resonant spectral contrasts due to phonons. Local variations of resonance positions and shapes are observed and correlated with known contrasts from electron microscopy. They give information on chemical identity, crystal structure, and mineral density. Our method should be straightforwardly applicable in many fields of general mineralogy, solid state research, and materials science.

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