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Infrared Phonon Fingerprinting of Nanocrystals through Broadband Near-Field Spectroscopy ALEXANDER S. MCLEOD, University of California, San Diego, GERARDO DOMINGUEZ, California State University, San Marcos, PRISCILLA KELLY, MARK THIEMENS, University of California, San Diego, LINGFENG M. ZHANG, University of California, San Diego; Boston University, ALEX RODIN, MICHAEL M. FOGLER, University of California, San Diego, FRITZ KEILMANN, Max Planck Institute of Quantum Optics and Center for NanoScience, D.N. BASOV, University of California, San Diego — Near-field infrared spectroscopy has recently been demonstrated with the capability to resolve optical properties of sub-wavelength sample areas across a broad range of infrared frequencies. This method holds promise for the direct identification of sub-wavelength chemical composition in nanostructured and heterogeneous samples. We apply this technique to the study of phonon-resonant silicon carbide nanocrystals tens of nanometers in size using an apertureless scanning near-field optical microscope (SNOM) coupled to a pulsed broadband infrared laser source and FTIR spectrometer. We present measurements of nanocrystal near-field spectra in the range of 700-1200 cm^{-1} evaluated in comparison with the near-field spectra of bulk silicon carbide, calibrated using ellipsometry. A detailed analytic model of the probe-sample near-field interaction is applied for the identification of nanoscale resonant size effects. These techniques provide a powerful method for identifying and characterizing sub-wavelength nanocrystals in heterogeneous samples via near-field infrared "phonon fingerprinting."

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