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Phonons in Soft Microstructures

GEORGE FYTAS, Dept. of Materials Science and Technology, Univ. of Crete and FORTH, Heraklion, Crete, Greece and Max Planck Inst for Polymer Research, Maniz, Germany

Among the inelastic scattering methods only Brillouin light scattering spectroscopy possesses sufficient resolution to record the rich phonon spectrum S(q,ÿ) of soft microstructures. Ordered systems with spacing qd=0(1) (q being the scattering photon wavevector) and elastic constants varying in space control the propagation of several high frequency excitations. Besides the acoustic phonon of the effective medium, "Bragg" modes due to the interaction of q with the phonon wavevector k and the reciprocal lattice vector G, mixed phonons of the phononic band structure and vibrational eigenfrequencies can contribute to the S(q,ÿ) of ordered polymer and colloidal systems. We present rich phonon dispersion relations in polystyrene opals, ordered diblock copolymers and interference lithography patterned single crystalline polymer films. Theoretical calculations of dispersion relations were performed to explain the nature of the observed propagation modes.