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Acoustic Spectroscopy for Colloids Dispersed in a Polymer Gel System

Bibliography for Related Journal Article:

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The technique of acoustic spectroscopy offers some significant advantages over conventional techniques, such as dynamic light scattering or differential sedimentation (centrifugation) for the characterization of colloidal dispersions in that it does not require that the systems be highly dilute and transparent. Another advantage of the method may derive from the fact that in application, relative motion between any particle and the medium is very small, at the most being comparable to the particle size. It may thus be suited, within limits, to the study of dispersions in polymer gels, without the additional limitation of conventional methods to transparent media (matching refractive index of polymer and liquid). The present work seeks to probe experimentally the limits of the technique and its current theory for the determination of particle size distributions in gel media. Experiments measuring acoustic attenuation have been conducted on dispersions of silica particles of varying size in aqueous hydroxylpropyl cellulose (HPC) gels of varying cross link density. The particle size distribution (PSD) was successfully measured by acoustic attenuation theory for dispersions in Newtonian media provided that the hydrodynamic particle diameter, was less than the hydrodynamic mesh size of the gel, as given by simple rubber elasticity theory, (mesh size / particle size 1.5). The same results were obtained at particle loadings of up to 15 wt%. If the particles are larger than the mesh size, a viscoelastic response from the gel matrix is observed which cannot be interpreted to yield particle size using the existing theoretical framework.