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An ultrasonic technique using shear waves interactions to characterize new hybrid gels

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Thickness shear mode transducer techniques using AT-cut quartz crystal can be used to measure viscoelastic parameters of soft materials (gels, colloidal suspensions ...) during their formation. Today the control of hybrid materials synthesis and evolution has a great interest, particularly for biomedical applications like drug delivery. With those materials, a challenge is to obtain new structures constituted by Interpenetrating organic- inorganic Polymers Networks (IPN) to get novel therapeutic behaviours.
In this paper, the monitoring of ultrasonic shear waves propagation in the material at 6 MHz is presented for different thermosensible hybrid (poly-N-isopropylacrylamide (PNIPAM) - silica). We show that at a mesoscopic scale it is possible to analyze mechanical interactions between different networks related to chemical bounds. The network evolution observed with our technique is in good agreement with the Fourier Transform Infra Red analysis of NIPAM polymerization. As shown in previous work for silica gels, a precursor characteristic time of gelation process (in liquid phase) can be determined to describe the polymerization kinetic. By its nondestructive character and its simplicity of measurement, this technique allows an online optimization of new hybrid materials.