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MAGNETO-RHEOLOGY OF NANOCOMPOSITES MATERIALS BASED ON BIOPOLYMERS

A. Ponton*, C. Galindo-Gonzalez

Laboratoire Matière et Systèmes Complexes, Université Paris Diderot-Paris 7 et CNRS, Bâtiment Condorcet 75205 Paris Cedex 13

**Corresponding author: alain.ponton@univ-paris-diderot.fr*

Among the new class of functional materials that have received increasing attention in recent years, magneto-sensitive soft materials have great potential for biomedical or engineering applications. In this context the objectives of this work are the elaboration and the multi-scale study of new magneto-responsive biopolymer-based materials prepared by introduction of functionalized magnetic nanoparticles of maghemite in aqueous solutions of sodium alginate, a polysaccharide extracted from marine brown algae, gelled by controlled release of calcium ions. In a first step the rheological properties of nanocomposites biopolymer solutions of sodium alginate / citrated ferrofluid without magnetic field and the formation of micron droplets of demixing are connected to a change in ionic strength. The analysis of the elongation of these droplets of demixing observed locally in the presence of a controlled and uniform magnetic field of the order of few Mt was used to determine their interfacial tension and magnetic susceptibility. The local viscosity was then calculated from the relaxation time after switching off the magnetic field. In a second step we develop an original magneto-rheological cell which allows to perform flow and viscoelastic measurements at controlled temperature and values of DC magnetic field of maximum value of 50 mT in the current configuration. We clearly demonstrated for the first time to our knowledge a magneto-viscoelastic effect in biopolymer networks that is manifested by an increase in viscosity at low shear and an increase in linear viscoelastic moduli.