SOME RESULTS ON THE MECHANICS OF SOFT AND INVERSE FREEZING GELS

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ABSTRACT

The ability of soft gels to absorb energy is related to their mechanical and structural properties, such as flow stress, strain rate sensitivity, viscosity and amorphous structure. Those features can be designed and improved at the molecular lever e.g. by reinforcing the gel structure with tough nanoparticles.

Equally interesting is the tendency of some gels to undergo inverse freezing, namely the ability of a liquid gel to solidify upon temperature increase. Inverse freezing improves the gel properties in two main aspects. First is the significant increase of flow stress with the temperature. Second, while most of the gels experience degradation in the solid-like state while melting or drying when exposed to high temperatures, inverse freezing gel retains and even improves those properties.

This work, which results from a close cooperation between our Chemistry and Mechanical Engineering Departments, will report on selected mechanical properties of Methyl-Cellulose (MC) based inverse freezing gel. Specifically, we will address the quasi-static and dynamic pmechanical properties of MC gel at various temperatures and strain rates and temperatures.

We will also discuss reinforcement of the specific MC based gels using several types of nanoparticles and chemical additives.

Finally, we will address impact energy absorption of those materials and their unique impact-induced gelation response.