Measurement of Liquid to Gel Phase Transition Temperature and Critical Exponents in Agar

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The agar is a hydrophilic colloid extracted from some red marine algae which are soluble in boiling water, and performed a reversible liquid to gel phase transition which presents a high hysteresis between the melting and gelling temperature. The importance of this material is due to the properties mentioned before, and because of that it is widely used in many scientific and industrial areas.

The sol-gel phase transition dynamics of agar, using an optical method is presented. The sample is illuminated with a non-coherent light source and the measurement of the transmitted light in the frontal direction is performed with a photodiode. Sol-gel aqueous solutions of agar present a phase transition around 40 °C depending on the agar content, however the width of the transition and the subsequent process occurring after it, are not well understood. In this work, it is shown that the phase transition as a function of the temperature can be followed using our experimental arrangement. It is shown that close to the phase transition, the transmitted light presents spontaneous fluctuations followed by a systematic decrease.

Results for three different concentrations of agar are presented: 0.5%, 1.5% and 2.5% w/w. Our results are compared with the classical rheological method, showing an excellent agreement of the phase transition temperature. In addition, our method provides the basis for the study of the whole phase transition, showing that the process continues even after the phase transition temperature has been surpassed, and it is also possible to calculate the critical exponents of the liquid to gel phase transition.