

Abstract for GR-TR Conference on Statistical Mechanics and Dynamical Systems

Talk Invited

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Observation of network formation, fractal nature, universality, internal morphology of the polymer networks: theory and experiment

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A new approach for in situ monitoring of the monomer conversion based on the chemical interaction of a fluoroprobe with polymer chains during the polymerization has been developed.[1] It is proved that the change in the emission spectra of the fluoroprobe during polymerization and gelation is used for *in situ* monitoring of the monomer conversion with great sensitivity.[2] Then, real-time fluorescence measurements have been developed for measuring the fractal dimension d_f and critical exponents γ and β simultaneously during the sol-gel transition of acrylamide hydrogels.[3] We observed that d_f passes through a minimum value of 2.5 at the percolation threshold and crossover to 3 above it. The exponents γ and β , measured at the threshold were found to be around 1.8 and 0.45, respectively. All parameters agree with percolation results. In addition a new method is developed for measuring the density distribution and the weight fraction of "the frozen blob clusters" in heterogeneous hydrogels via direct current measurements.[4] It is proved that the current density decreases with time as a series of exponentials where the exponents and the multipliers measure the density and the weight fraction of the corresponding blob generation, respectively. The number of terms in the series that fit best with the experimental data indicates the number of generations of the blobs.[5] This seems like a decomposition of Kohlrausch's stretched exponential function, which gives a bird's-eye view of the internal morphology of a heterogeneous medium.

[1] Yilmaz, Y., et. al., *Spectrochimica Acta A* **72**, 332 (2009).

[2] Kizildereli, N., et. al., *J. Appl. Polym. Sci.* **115**, 2455 (2009).

[3] Yilmaz, Y., et. al., *Phys. Rev. E* **77**, 051121 (2008).

[4] Yilmaz, Y., et. al., *J. Chem. Phys.* **125**, 234705 (2006).

[5] Alveroglu, E., et. al., *in preperation*.