Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Anomalous diffusion dynamics of associating artificial proteins in hydrogels SHENGCHANG TANG, MUZHOU WANG, BRADLEY OLSEN, Massachusetts Institute of Technology — Associative polymer gels have attracted a great deal of interest as responsive materials and biomaterials; while a great deal is known about their mechanical properties, knowledge about self-diffusion in these materials is still limited. Using coiled-coil proteins as a model associative polymer system where the number of stickers per polymer and molar mass of chains between stickers are exactly defined, we investigate self-diffusion in associative polymer hydrogels using forced Rayleigh scattering on the length scales ranging from 0.3 to 50 μm. Although the presence of associative groups reduces the rate of diffusion, "superdiffusive" scaling is observed for the first time up to a length scale of 10 μm. Fickian diffusion is recovered at larger length scales. The anomalous diffusion strongly depends on the temperature and the hydrogel concentration. We propose a simple two state model to capture the interplay between the diffusion of the proteins and the association of the coiled-coil segments. The model is able to capture both the anomalous regime and the Fickian regime, and provides estimation of the apparent diffusivities and the dissociation rates of the coiled-coil domains.

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Date submitted: 31 Oct 2014 Electronic form version 1.4