Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Directed percolation identified as equilibrium pre-transition towards non-equilibrium arrested gel states MARCO LAURATI, RONJA CAPELLMANN, MATTHIAS KOHL, STEFAN EGELHAAF, MICHAEL SCHMIEDEBERG, University of Düsseldorf — The macroscopic properties of gels arise from their slow dynamics and load bearing network structure, which are exploited by nature and in numerous industrial products. However, a link between these structural and dynamical properties has remained elusive. Here we present confocal microscopy exper- iments and simulations of gel-forming colloid-polymer mixtures with competing interactions. They reveal that gel formation is preceded by continuous and directed percolation. Both transitions lead to system spanning networks, but only directed percolation results in extremely slow dynamics, ageing and a shrinking of the gel that resembles syneresis. Therefore, dynamical arrest in gels is found to be linked to a structural transition, namely directed percolation, which is quantitatively associated with the mean number of bonded neighbours. Directed percolation is a universality class of transitions out of equilibrium, our study hence connects gel formation to a well-developed theoretical framework which now can be exploited to achieve a detailed understanding of arrested gels.

Marco Laurati
Universidad de Guanajuato

Date submitted: 01 Dec 2015 Electronic form version 1.4