Multi-fractal behavior of sol-gel transition of anisotropic colloidal particles suspension

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Aggregation and gelation of concentrated colloidal suspensions is a fascinating topic both from a fundamental as well as a technical point of view. In this work, we analyze the dynamical behavior of scattered light intensity of the colloidal Laponite(Si8[Mg5.5 Li0.4 H4.0 O24.0]0.7 Na0.7) nano particles suspension during the Sol-Gel transition by the multi-fractality behavior. Dynamic light scattering(DLS) have been used due to the transparency of suspension and small sized particles to characterize the evolution of the Sol-Gel reaction in terms of the size of the growing gel particles. Using rescaled range analysis (R/S) and extended self-similarity (ESS) on light scattering intensities of Laponite, we described the sol-gel transition during ageing. By increments of the intensity of the light scattering through the liquid like suspension of colloidal particles in the water, we rely on the temporal variation of non-Gaussian parameter as an estimator and criteria of phase transition occurrence in the underlying sample. We find that for far enough from phase transition, the non-Gaussian parameter is almost time independent, while including phase transition, it becomes extremely fluctuated which means unexpected events grow in our system. The Hurst exponent extracted from R/S analysis increased during gelation time and afterward saturated where the system evolutes from ergodic to non-ergodic state (strongly correlated system). Considering the relation between the Hurst exponent and the diffusion coefficient, particle's aggregate as this coefficient decreases by gelation time indicating that the system enters the gel state.