Thursday, November 10, 2016 - 10:30 to 12:00
Strand Session: Radiation Processing, Polymerization and Grafting Approaches for Materials Development

On the mechanism of radiation synthesis of nanogels

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Radiation-engineered poly(N-vinyl pyrrolidone) nanogels are very interesting biocompatible nanocarriers for i.v. administration of therapeutics and contrast agents for bioimaging among other applications. Nanogels are usually produced upon irradiation of dilute aqueous polymer solutions. Under these conditions, the polymer radicals formed primarily react via intramolecular radical-radical combination forming intramolecular crosslinks. The manufacturing process is fast and effective and grants excellent control of particle size and simultaneous sterilization of the formed nanogels. Interestingly, primary amino groups and carboxyl groups, useful for (bio)conjugation, are also formed in a dose-dependent fashion when manufacturing PVP-nanogels. In this presentation, the origin of nanogel size control and functionalization are discussed in relation to dose, dose rate, polymer concentration and chemical conditions. The discussion is based on recent experimental work and kinetic simulations. This understanding offers a new dimension for the design and production of radiation-sculptured multifunctional nanocarriers from aqueous solutions of polymers. In addition, the inherent boundaries of these systems in terms of are explored.