Prof. Igor I. Potemkin
Lomonosov Moscow State University, Physics Department

Polymer Microgels: Permeability of Soft Colloidal Particles Leads to Sophisticated Properties

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Abstract: Internal structure of nano- and microgels resembles elements of macroscopic polymer network: linear chains (subchains) are covalently linked with each other into three-dimensional frame of the size in the range between tens of nanometers and few microns. As a result, the microgels reveal the properties of soft colloidal particles which are permeable for solvent and dissolved (macro)molecules. The most remarkable property of the microgels is their ability to swell and collapse under variation of environmental conditions (temperature, pH, etc.). This property can efficiently be exploited in many applications, in particular, for uptake and release of guest molecules. It has been shown recently that the microgels can serve as “soft”, permeable and stimuli responsive alternative of solid particles which can stabilize emulsions. Such emulsions have peculiar properties and can easily be destroyed under external stimuli leading to desorption of the microgel particles.

In the present paper, we report about few effects which are characteristic for the microgels. In particular, we demonstrate ability of polyampholyte core-shell microgels to serve as Coulomb trap, when charged shell of the microgel can create a potential barrier enforcing similarly charged nanoparticles (proteins) to be locked inside the core [1]. Microgels adsorbed at water-oil interface [2,3] reveal peculiar behavior comprising ability to mix two immiscible liquids (oil and water) inside the microgel [4-6]. They demonstrate very efficient catalytic activity [7] in reactions for which two immiscible reactants can be mixed in the presence of a catalyst inside the microgel and react. It is shown that the microgels can serve as scavengers of substances dissolved in water [8]. Permeability of microgels adsorbed on a porous substrate is discussed [9].

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