

Mesoscopic Properties of Solutions and Liquid Mixtures as Revealed by Light Scattering Techniques

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A long-term research results on mesoscopic structures in solutions and liquid mixtures will be overviewed. They comprise mostly of light scattering experiments and cover a very broad range of compounds in solution, going from atomic inorganic salts through organic low molecular weight compounds to large macromolecules, including mixtures of liquids as well. An interesting and intriguing aspect is the presence of mesoscopic long-lived structures in cases where they are not expected based on trivial reasons. They are found in systems of well soluble solutes far from the immiscibility critical points and in mixtures of freely (in all proportions) miscible liquids [1,2]. Kinetics of the formation of these structures was also investigated, including real-time monitoring [3]. Solutions of ionic polymers (polyelectrolytes) exhibit the presence of mesoscale supramolecular structures (called polyelectrolyte domains), in spite of the fact that clustering of likely charged polymer chains is counterintuitive at first glance. The presence of domains was found in solutions of tens of different polyelectrolytes and reported in hundreds of papers over last three decades. Several theoretical approaches were developed to explain the phenomenon, but apparently none of them is currently capable of explaining majority of experimental findings. A brief outline of our work on this issue will be given [4-9]. Introduction of thermosensitive hydrophobic groups into polyelectrolytes leads to decreasing of solvent quality upon temperature change, nevertheless the spinodal or binodal macroscopic phase separation is not observed. Instead the process ends on a mesoscopic level. Mesophases can be further stabilized by specific physical interactions and may also find practical use (custom-tailored polymeric nanoparticles with interesting properties) [10,11].

[1] M.Sedlák, J.Phys.Chem. B, 110 (9), 4329 - 4338, 2006.

[2] M.Sedlák, J.Phys.Chem. B, 110 (9), 13976 - 13984, 2006

[3] M.Sedlák, J.Phys.Chem. B, 110 (9), 4339 - 4345, 2006.

[4] M.Sedlák, in *"Physical Chemistry of Polyelectrolytes"*, p. 1-58, (T. Radeva ed.), Marcel Dekker, New York, 2001.

[5] M.Sedlák, Langmuir 15, 4045-4051,1999.

[6] M.Sedlák, J.Chem.Phys.116, 5236-5245, 2002

[7] M.Sedlák, J.Chem.Phys.116, 5246-5255, 2002

[8] M.Sedlák, J.Chem.Phys.116, 5256-5262, 2002

[9] M.Sedlák, J.Chem.Phys.122, 151102, 2005.

[10] M.Sedlák, Č.Koňák, Macromolecules, 42, 7430–7438, 2009.

[11] M.Sedlák, Č.Koňák, J.Dybal, Macromolecules, 42, 7439–7446, 2009.