

Kinetics and characterization of polyelectrolyte complexes prepared through a stopped-flow approach

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The complexation of polyions into so-called polyelectrolyte complexes (PECs) represents a family of non-covalent reactions of prime importance in several natural and industrial processes. It has been known for a long time that the formation of PECs is an extremely fast process with typical reaction times lying in the microsecond range which corresponds to the diffusion-collision of oppositely charged polyions. The very short reaction time associated to the strength of electrostatic interaction and steric hindrance of polyions favors the formation of kinetically-trapped structures. Therefore, the mixing time which is related to the way the polyions are mixed has a marked influence on the structure and stability of PECs as reported by many authors¹. Here, we propose to use a stopped-flow instrument having a dead time in the millisecond range with the idea of not only gaining new insight into the kinetics of complexation but also, for the first time, preparing PECs in very fast and highly reproducible manner². The morphology of such PECs was investigated by a range of characterization techniques, mostly light scattering, small-angle neutron scattering and atomic force microscopy (Figure 1). Different polyelectrolyte systems and complexation conditions have been studied and the fast mixing approach compared to other ways of mixing like the simple titration.

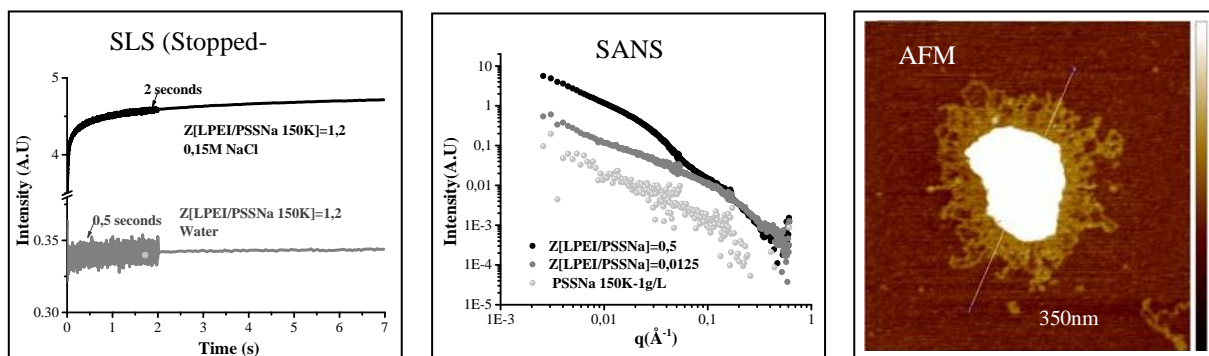


Figure 1. Characterization of polyethyleneimine/polystyrene sulfonate (PEI/PSS) PECs prepared through ultra-fast mixing of polyions in a stopped-flow instrument at various Z molar charge ratios.

1 E.S. Dragan, M. Mihai, S. Schwarz *Colloid Surf. A* **2006**, 290, 213

2 J. Zhang, S. Chen, S. Zhu, S. Liu *Phys Chem Chem Phys* **2014**, 16, 117