Self-assembly of oppositely charged patchy and isotropic colloids binary mixture

Ethayaraja Mani*, Sabapathy Manigandan, Remya Ann Mathews

Polymer Engineering and Colloid Science Laboratory, Department of Chemical Engineering, Indian Institute of Technology Madras, Chennai - 600036, India

**ethaya@iitm.ac.in*

Colloidal particles, with site-specific interactions, known as patchy particles are promising candidates to study self-assembly leading to the formation of complex hierarchical structures. We recently presented a simple synthetic route to produce patchy particles with tunable patch size at fluid-water interfaces [1]. This method allows one to create a patch of gold or silica on positively charged polystyrene particles. The as-grown layer of silica or gold on the surface can be further engineered to have negative charges and therefore the particles formed in this approach are bi-polar in nature. These patchy particles form finite sized aggregates in deionized water and in electrolyte solution. We find that the cluster size distribution can be controlled by varying the salt concentration and volume fraction of the particles. Further, we present results on clustering in a mixture containing bi-polar patchy particle and charged isotropic particles. We find that the patch size (coverage) controls the cluster size distribution. Due to the competition between attractive and repulsive electrostatic interactions, the cluster growth is found to be self-limiting. The clustering process is characterized by dynamic light scattering and high resolutions scanning electron microscopy. The experimental results are compared with Monte Carlo simulations to understand the complex interplay of patchy and electrostatic interactions that dictate the cluster size and composition.

Acknowledgements The financial support of Department of Science and Technology, India is acknowledged.

[1] M. Sabapathy, V. Kollabattula, M. G. Basavaraj and E. Mani, *Nanoscale*, 2015, **7**, 13868.