Proceedings International
Platinum Open Access Journal (ISSN 2668-6384)

Proceedings, Abstract
Volume 3, Issue 2, 2021, 12 - 13
https://doi.org/10.33263/Proceedings32.012013

Probing Interactions in Reentant Phase Behavior of Charged Colloids †

V.K. Aswal [1,*]

[1] Solid State Physics Division, Bhabha Atomic Research Centre, Mumbai 400 085, India;
* Correspondence: vkaswal@barc.gov.in (V.K.A.);
† Presented at Virtual International Conference on Physical Sciences (ICPS - 2021)
Received: 1.02.2021; Revised: 3.02.2021; Accepted: 4.02.2021; Published: 5.02.2021

Abstract: The charged nanoparticles in solution represent a model system, where the well-established colloidal theories such as Debye-Hückel (DH) theory and/or DLVO theory can be implemented to predict the nanoparticle phase behavior. Recently, reentrant phase transitions in a wide range of colloids (e.g., inorganic and organic nanoparticles, polymers, and biomolecules) have been observed, not consistent with these theories. The colloids in the reentrant phase behavior undergo a phase change and return to the original phase concerning a specific physiochemical parameter (e.g., ionic strength, the concentration of different additives, temperature, etc.). The nanoparticle-polymer/multivalent-ions systems, demonstrating such phase transition and the corresponding phase behavior in terms of interparticle interactions, have been probed by small-angle neutron scattering. It is shown how the tuning in interparticle interactions using external parameters leads to reentrant phase behavior [1-6].

Keywords: charged colloids; Debye-Hückel (DH) theory; phase transtion and neutron scattering.

Funding

This research received no external funding.

Acknowledgments

This research has no acknowledgment.

Conflicts of Interest

The authors declare no conflict of interest.

References

1. Kumar, S.; Ray, D.; Aswal, V.K.; Kohlbrecher, J. Structure and interaction in the polymer-dependent reentrant phase behavior of a charged nanoparticle solution. *Physical Review E* **2014**, *90*, https://doi.org/10.1103/PhysRevE.90.042316.
2. Kumar, S.; Aswal, V.K.; Kohlbrecher, J. Small-Angle Neutron Scattering Study of Interplay of Attractive and Repulsive Interactions in Nanoparticle–Polymer System. *Langmuir* **2016**, *32*, 1450-1459, https://doi.org/10.1021/acs.langmuir.5b03998.
3. Kumar, S.; Yadav, I.; Abbas, S.; Aswal, V.K.; Kohlbrecher, J. Interactions in reentrant phase behavior of a charged nanoparticle solution by multivalent ions. *Physical Review E* **2017**, *96*, https://doi.org/10.1103/PhysRevE.96.060602.
4. Ray, D.; Kumar, S.; Aswal, V.K.; Kohlbrecher, J. Tuning Nanoparticle–Micelle Interactions and Resultant Phase Behavior. *Langmuir* **2018**, *34*, 259-267, https://doi.org/10.1021/acs.langmuir.7b03429.

5. Kumar, S.; Ray, D.; Abbas, S.; Saha, D.; Aswal, V.K.; Kohlbrecher, J. Reentrant phase behavior of nanoparticle solutions probed by small-angle scattering. *Current Opinion in Colloid & Interface Science* **2019**, *42*, 17-32, https://doi.org/10.1016/j.cocis.2019.02.010.
6. Kumar, S.; Yadav, I.; Ray, D.; Abbas, S.; Saha, D.; Aswal, V.K.; Kohlbrecher, J. Evolution of Interactions in the Protein Solution As Induced by Mono and Multivalent Ions. *Biomacromolecules* **2019**, *20*, 2123-2134, https://doi.org/10.1021/acs.biomac.9b00374.