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SURFACE MODIFICATION OF VARIOUS MORPHOLOGY $GdPO_4$ PARTICLES USING CATIONIC BRUSH COPOLYMERS

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Development of both micro and nano sized particles with different structure and morphology has increased significantly in recent years as morphology could be responsible for some of physicochemical properties of particles. Rare-earth doped –micro and –nano orthophosphate particles are promising host materials as they possess good both chemical and thermal stability, appropriate luminescent properties and are already applied as luminescent phosphors, down/up-conversion materials, catalysts and so on [1, 2]. As phosphates are biologically inert host – these particles show high potential to be applied in bio-related fields such as MRI contrast agents, bio-labeling, drug delivery etc. [3]. However, applicability of such particles is limited by poor stability in aqueous solutions. The usage of various commercial surfactants (eg. oleic acid, TRITON, TWEEN etc.) cannot ensure desired stability of $LnPO_4$ particles. It is known that polymeric brush electrolytes have high potential to surface modification and stabilization of other nanoparticles (eg. SiO_2, TiO_2, Al_2O_3 etc.) [4, 5] and in our case the usage of non-linear polymeric materials could be a solution.

In this study, we present the synthesis of cationic brush polyelectrolytes and their use in stabilization of $GdPO_4$ particles in aqueous media. Polymers of various compositions were synthesized via RAFT polymerization route. SEC equipped with triple detection (RI, DP, RALS, LALS) were used to determined molecular parameters (M_n, M_w, M_w/M_n). Thus exact composition of synthesized polymers were determined using combined spectroscopic methods (NMR, IR, RAMAN). Cationic brush polymers were used to improve stability of aqueous $GaPO_4$ particle dispersion. Firstly, the IEP points of different morphology $GdPO_4$ particles (nanorods, nanoprisms, nanospheres) were found by measuring zeta potential of bare particle dispersions under various pH values. The oppositely charged particles (negatively charge in alkaline media pH ~ 10) in dispersion were treated by cationic polyelectrolytes of different compositions. The concentration and composition effects of used polymers on change of particle surface potential and stability (DLS measurements) in dispersions were investigated and presented in this work.

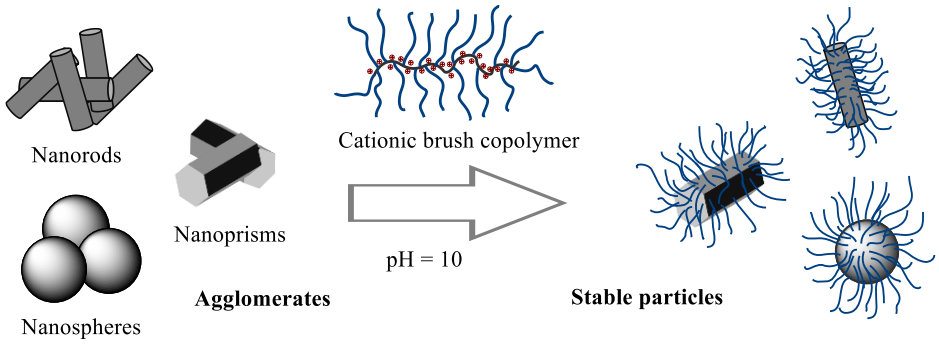

Fig. 1. Graphical illustration of $GdPO_4$ with different morphology (nanorods, nanoprisms, nanosperes) stabilization by using cationic brush copolymers

References

1. Z. Wang et al., CrystEngComm, **20** (2018) 796-806.
2. M. Ferhi et al., Journal of Alloys and Compounds **714** (2017) 144-153.
3. Q. Yang et al., RSC Advances, **8** (2018) 12832-12840.
4. V. Klimkevicius et al., Langmuir **31** (2015) 2074–2083.
5. Y. de Hazan et al., Journal of Colloid and Interface Science **365** (2012) 163–171.