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Synthesis and organic-inorganic interface of colloidal lead chalcogenide nanocrystals

Danylo Zherebetskyy
Lawrence Berkeley National Laboratory, USA

Colloidal nanocrystals (NC) are very promising building blocks for materials with designed functions due to their wide and easy tunability of catalytic, electronic, and optical properties by adjusting the NC composition, shape and size1. The chemistry of organic/inorganic interface in colloidal NC plays an essential role in the synthesis and growth, and strongly affects physical and chemical properties of NC. In spite of advances in the synthesis of NC and significant efforts in comprehension of chemical reactions, reaction products and surface chemistry, an understanding of chemical reactions and how organic molecules bind and pack on nanocrystal surfaces is still ambiguous.

In thermodynamic equilibrium, the shape of a NC is determined by the minimization of the surface Gibbs energy for a given volume according to the Wulff construction. Taking into account the NC surface-ligand interface, the surface energy of each NC facet depends on both surface energy of the unpassivated surface and the adsorption energy of ligands on this surface. Furthermore, the adsorption energy of ligands is defined by equilibrium ligand coverage and external conditions such as temperature and ligand concentration.

Two facets most frequently exposed by Pb chalcogenide are the {001} and the {111} facets[2]. Furthermore, it should be noted that the colloidal PbS nanocrystals are nonstoichiometric with excess of Pb atoms and Pb:S ratio ranging from 1.2 to 1.6[3]. Next experimental fact that should be taken into account is that the synthesized QD are capped almost exclusively by oleic acids. Moreover, number of oleic acid ligands should match the number of excess Pb atoms[3].

In our study, we are focusing on the reactions that take place in solution and on NCs surfaces to explain organic/inorganic interface of PbS QD colloidal solutions. We propose computational models which are based on and try to satisfy all experimental facts described above. We predict that {111} facets contain -OH groups due to possible reactions of formation in solvent and on surface of QDs, and steric effects. Finally, we propose first model of a real colloidal PbS-QD with surface ligands which carefully based on synthesis reactions and satisfies all key experimental facts.

1. Yin Y., Alivisatos A. P. Nature 437, 664-670 (2005)
2. Jun Y., Lee J., Choi J., Cheon J. J. Phys. Chem. B 109, 14795-14806 (2005)
3. Moreels I., Fritzinger B., Martins J. C., Hens Z. J. Am. Chem. Soc. 130, 15081-15086 (2008)

Biography

Danylo Zherebetskyy received his Ph.D. in Applied Mineralogy at the University of Salzburg (Austria) during the period of February 2007 to March 2010. Currently, he is Postdoctoral Researcher at the Lawrence Berkeley National Laboratory in Lin-Wang Wang's group studying organic/inorganic interface of nanosystems.

dzherebetskyy@lbl.gov

Hardness variations on a hydrogenated tin brass heat exchanger

Amjad Saleh El-Amoush
Al-Balqa Applied University, Jordan

Tin brass heat exchanger tube was hydrogen charged under different cathodic charging conditions. The introduction of charged hydrogen into tin brass tube was found to induce hardening on its surface. The severity and the depth of the hardened region was observed to increase with either cathodic current density or charging time. Ageing after charging results in either complete or partial recovery of hardness, depending on the charging conditions applied to heat exchanger tube.

Biography

Amjad Saleh El-Amoush is an Assistant Professor of Materials and Metallurgical Dept. at Al-Balqa Applied University. He has done his Ph.D. at National Technical University of Athens, Greece. He was Inspector for various industrial companies in Greece and reviewer for Journal of Alloys and Compounds. He is the member of Jordan Engineers Association and Hellenic Ceramic Society (HIC). He has published 21 papers in reputed journals.

el_amoush_as@yahoo.com