Physikalisches Institut
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Albert-Ludwigs-Universität Freiburg

QE

Quantum Efficiency Seminar und Colloquium

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All-Inorganic Design of Functional Nanomaterials Using Colloidal Nanocrystals

Many materials in the form of well-defined nanoscale crystals (“nanocrystals”) exhibit unique properties due to size effects and large surface-to-volume ratios. Yet it is clear that the utilization of nanomaterials in modern technologies requires their integration into solid-state structures with programmable electronic, magnetic and optical properties. The clear challenge is the rational design of this novel type of condensed matter, in which the size-tunable individual properties of nanoscale building blocks are enhanced by their interactions and by the macroscopic properties of their ensembles.

To achieve high degree of electronic coupling, the nanocrystal surface chemistry and surrounding medium need to be properly engineered. To address these issues, we developed a general approach for replacing highly insulating organic capping ligands from the nanocrystal surface with electronically conductive inorganic molecular species [1]. The combinations of common metals and chalcogens such as SnS44-, SnTe44-, In2Se42-, Sn2S64-, SbSe43- etc. were employed as surface capping ligands. I will discuss various aspects of the synthesis, assembly, and integration of all-inorganic nanocrystals into field-effect transistors, infrared devices [2] and electrochemical storage media (Li-ion batteries) [3].

1. M. V. Kovalenko, M. Scheele, D. V. Talapin, *Science*, **324** (2009), 1417-1420.
2. M. V. Kovalenko, R. D. Schaller, D. Jarzab, M. A. Loi, D. V. Talapin, *Journal of the American Chemical Society*, **134** (2012), 2457-2460.
3. K. Kravchyk, M. Bodnarchuk, M. Yarema, L. Protesescu, M. V. Kovalenko. *Submitted*.

Date: **Tuesday, July 3rd, 2012 14:15 pm**
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