

Synthesis of PbS Nanostructures

Sascha Kull^a and Christian Klinker^a

^a*Institute of Physical Chemistry, University of Hamburg, Hamburg, Germany*

Electrical devices based on semiconductor nanostructures are of great interest in research (e.g. as absorber material for solar cells). Nanostructures therefore possess unique characteristics compared to their bulk material if matter is confined in at least one dimension. By controlling the size and dimensionality of nanostructures (e.g. 0D nanoparticles, 1D nanowires or 2D nanosheets) in the regime of electrical confinement characteristics like absorbance/emittance of light can be tuned. Another challenging aspect beside the synthesis of well defined nanostructures is their applicability in building electrical devices like solar cells or transistors. Therefore 2D semiconductors are of special interest. They combine the possibility of tuning the bandgap and influence the behaviour of charge carriers while their lateral dimension can reach up to several microns and enable usage as a building block in electrical devices.[1]

Lead(II)sulfide (PbS) with a bandgap in the near infrared range has a cubic rocksalt type crystal structure. With the right choice of reaction parameters like the nature of the ligand, the ligand concentration and the reaction temperature PbS nanostructures can be synthesised as 0D, 1D and 2D colloidal nanocrystals with at least one dimension in electronic confinement. Further the synthesised 2D PbS has been investigated as a field effect transistor.[2]

The formation of PbS nanosheets is supposed to be via the oriented attachment mechanism of PbS seeds enabling a kinetic driven 2D nanosheet instead of the thermodynamic growth to nanoparticles. We further investigate the possibility of an additional ripening mechanism to adjust the PbS nanosheets shape, achieve more complex colloidal nanostructures in terms of geometry and investigate the influence of this geometry on the electrical transport through these nanostructures.

1) T. Bielewicz *et al.*, *small*, **2015**, 11, 7, 826.

2) T. Bielewicz *et al.*, *Chem. Mater.*, **2015**, 27, 8248.