Synthesis of highly fluorescing semiconducting core-shell nanoparticles based on IB, IIB, IIIA, VIA elements of the periodic classification.

Abstract

A method for the preparation of semiconducting core-shell nanoparticles comprising elements of the groups IB, IIB, IIIA, IVA, VA or VIA of the periodic classification wherein the composition of the core nanoparticle is selected from the group consisting of IB-VIA, IIB-VIA, IIIA-VIA, IB-IIIA-VIA or IB-IIB-IVA-VIA, IIB-IIIA-VIA or IIB-IVA-VA or mixtures thereof, and at least one shell comprises elements of the groups IIB and VIA, , wherein in case the core composition is IIB-VIA the shell comprises at least a further element selected from the groups IB, IIIA, IVA or VA, said method comprising the following steps:

i.) Core reaction mixture comprising at least one cation metal precursors and an anion precursor is dissolved in a ligand and solvent mixture at a temperature that is still beneath the threshold at which nucleation takes place,

j.) Core reaction mixture is heated above nucleation threshold temperature and then kept at the reaction temperature for core nucleation,

k.) Optionally the heated reaction mixture is kept at a temperature well suited for core growth but lower than the nucleation temperature,

l.) Shell reaction mixture prepared separately comprising at least one cation metal precursors and an anion precursor and heated at a temperature that is still beneath the threshold at which nucleation takes place is added to the reaction mixture of step b) or c) for shell coating of the core nanoparticles,

m.) reaction mixture of step d) is heated and hold to a shell growth temperature,

n.) optionally for ZnS shell preparation shell reaction mixture comprising ZnS shell material is prepared separately and heated at a temperature that is still beneath the threshold at which nucleation takes place is added to the reaction mixture of step d) or e) for shell coating of the nanoparticles,

o.) reaction mixture of step f) is heated and hold to a shell growth temperature,

p.) reaction mixture is then cooled down to prevent further particle growth.