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Fluorescent and water-dispersible ternary alloyed Cu- and Al-codoped ZnSeS/ZnS QDs

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Abstract:

Fluorescent and water-dispersible ternary alloyed Cu- and Al-co-doped ZnSeS/ZnS QDs with pure dopant emission have been synthesized through a simple aqueous synthetic route using 3-mercaptopropionic acid (3-MPA) capping ligand as (Figure 1). The influence of the Cu and Aldopant concentrations has been systematically investigated in order to optimize the Cu-related photoluminescence (PL) emission. Through the increase of the dopants concentration, a significant increase of the PL quantum yield of Cu,Al:ZnSeS/ZnS QDs was observed (up to 30%). PL excitation and time-resolved PL measurements were also conducted to study the PL mechanism.

structure and The crystal shape of Cu,Al:ZnSeS/ZnS core/shell QDs were investigated using XRD, TEM and HR-TEM. XRD reveals that QDs exhibit the zinc blende crystal structure. With the increase of the Al dopant concentration, a slight shift of the XRD peaks to small diffraction angle corresponding to the incorporation of Al³⁺ ions in the ZnSeS host was observed. TEM and HR-TEM results show that the nanocrystals have a spherical shape and a size around 2.8 nm. The composition of the QDs was also confirmed by XPS measurements. In addition, Cu,Al:ZnSeS/ZnS QDs exhibit a high photostability.

Keywords: Quantum Dots, , Core/Shell, Photoluminescence, Co-Doping, Stability.

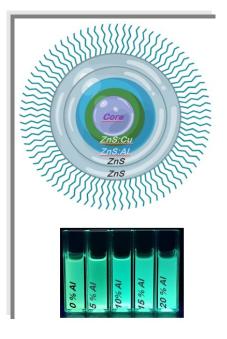


Figure 1: Schematic illustration of the structure of Cu,Al:ZnSeS/ZnS QDs and digital photograph taken under UV light illumination of the dots when varying the Al³⁺ dopant percentage.

References:

Jason K. Cooper, Sheraz Gul. (2015) Tunable Photoluminescent Core/Shell Cu⁺
Doped ZnSe/ZnS Quantum Dots Codoped with Al³⁺, Ga³⁺, or In³⁺. American Chemical Society.