



HAL
open science

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

Salima Mabrouk, Hervé Rinnert, Balan Lavinia, Ghouti Medjahdi, Rafik Ben
Chaabane, Raphaël Schneider

► **To cite this version:**

Salima Mabrouk, Hervé Rinnert, Balan Lavinia, Ghouti Medjahdi, Rafik Ben Chaabane, et al.. Fluorescent and water-dispersible ternary alloyed Cu- and Al-co-doped ZnSeS/ZnS QDs. Nanotech France 2021, Jun 2021, Paris, France. hal-03271347

HAL Id: hal-03271347

<https://hal.univ-lorraine.fr/hal-03271347v1>

Submitted on 25 Jun 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

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

Salima Mabrouk ^{a,b}, Hervé Rinnert ^c, Lavinia Balan ^d, Ghouti Medjahdi ^c, Rafik Ben Chaabane

^b, Raphaël Schneider ^{a,*}

^a Université de Lorraine, CNRS, LRGP, F-54000 Nancy, France

^b LIMA, LR011ES55, Faculté des Sciences de Monastir, Avenue de l'environnement, 5019, Tunisie

^c Université de Lorraine, CNRS, IJL, F-54000 Nancy, France

^d CEMHTI-UPR 3079 CNRS, Site Haute Température, 45071 Orléans, France

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) as capping ligand (Figure 1). The influence of the Cu and Al-dopant 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.

The crystal structure and 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.

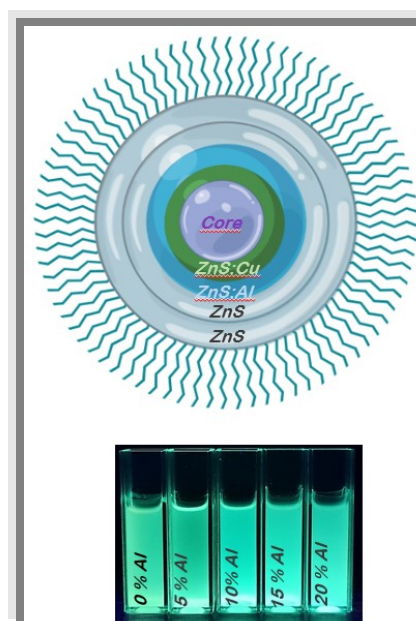


Figure 1: Schematic illustration of the structure of Cu,Al:ZnSeS/ZnS QDs and digital photograph taken under UV light illumination of the dots when varying the Al³⁺ dopant percentage.

References:

1. 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.