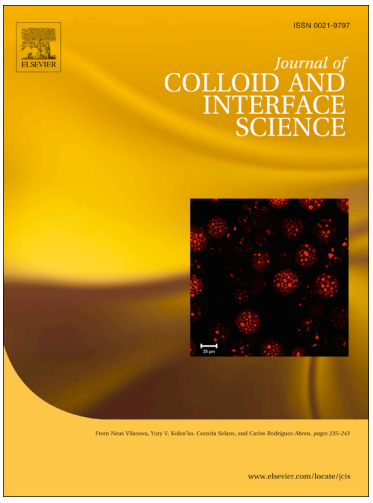

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C.H. Cheng, H.Y. Huang, M.J. Talite, W.C. Chou, J.M. Yeh, C.T. Yuan

PII: S0021-9797(17)30925-6
DOI: http://dx.doi.org/10.1016/j.jcis.2017.08.020
Reference: YJCIS 22667

To appear in: *Journal of Colloid and Interface Science*

Received Date: 25 May 2017
Revised Date: 9 July 2017
Accepted Date: 7 August 2017

Please cite this article as: C.H. Cheng, H.Y. Huang, M.J. Talite, W.C. Chou, J.M. Yeh, C.T. Yuan, A facile method to prepare "green" nano-phosphors with a large Stokes-shift and solid-state enhanced photophysical properties base on surface-modified gold nanoclusters, *Journal of Colloid and Interface Science* (2017), doi: http://dx.doi.org/10.1016/j.jcis.2017.08.020

A facile method to prepare "green" nano-phosphors with a large Stokes-shift and solid-state enhanced photophysical properties base on surface-modified gold nanoclusters

C. H. Cheng[1], H. Y. Huang[1]*, M. J. Talite[2], W. C. Chou[2], J. M. Yeh[3], C. T. Yuan[1]*

[1]Department of Physics, Chung Yuan Christian University, Taoyuan, Taiwan

[2]Department of Electrophysics, National Chiao Tung University, HsinChu, Taiwan

[3]Department of Chemistry, Chung Yuan Christian University, Taoyuan, Taiwan

Abstract

Colloidal nano-materials, such as quantum dots (QDs) have been applied to light-conversion nano-phosphors due to their unique tunable emission. However, most of the QDs involve toxic elements and are synthesized in a hazardous solvent. In addition, conventional QD nano-phosphors with a small Stokes shift suffered from reabsorption losses and aggregation-induced quenching in the solid state. Here, we demonstrate a facile, matrix-free method to prepare eco-friendly nano-phosphors with a large Stokes shift based on aqueous thiolate-stabilized gold nanoclusters (GSH-AuNCs) with simple surface modifications. Our method is just to drop GSH-AuNCs solution on the aluminum foil and then surface-modified AuNCs (Al-GSH-AuNCs) can be spontaneously precipitated out of the aqueous solution. Compared with pristine GSH-AuNCs in solution, the Al-GSH-AuNCs exhibit enhanced solid-state PL quantum yields, lengthened PL lifetime, and spectral blue shift, which can be attributed to the aggregation-induced emission enhancement facilitated by surface modifications. Such surface-treatment induced localization of AuNCs can restrict the surface-ligand motion, leading to the enhancement of PL properties in the solid state. In addition, the Al-GSH-AuNCs nano-phosphors with a large Stokes shift can mitigate the aggregation-induced PL quenching and reabsorption losses, which would be potential candidates for "green" nano-phosphors.

Key words: gold nano-clusters, solid-state nano-phosphors, aggregation-induced PL quenching, Stokes shift, reabsorption.

Corresponding authors: H. Y. Huang: estion53@yahoo.com.tw, C. T. Yuan: ctyuan@cycu.edu.tw