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Synthesis of Multifunctional Nanocomposite for Bioimaging and Cell Separation

Shobhit Charan [1,2], Narendra Singh [2], Mark Griep[2] and Peilin Chen [2]*

(1)Taiwan International Graduate Program, Nanoscience and Technology Program, Dept. of Chemistry, National Taiwan University, Taipei, Taiwan

(2)Research Centre For Applied sciences, Academia Sinica, Taipei, Taiwan, e-mail peilin@gate.sinica.edu.tw

* Coresponding Author

Abstract- The combination of both optical (fluorescent) and magnetic properties in a single material would enable simultaneous application in the field of biolabeling/imaging and cell sorting/ separation. Here, we present the synthesis and surface modification of magnetic semiconductor quantum dots (MQD) of CdSe-Fe_2O_3, with excellent quantum yield and monodispersity. The surface-modified MQD's were then used for live cell imaging in different cell lines such as NIH and 3T3 cells. It was found that the location of MQD's within the cell depends on their surface modifications. Hence, this mutlifunctional material has potential to be utilized in bioimaging and cell sorting applications.

Quantum dots (q-dots) of semiconductors of II-VI are extensively well-known for various applications in luminescent devices, biological markers, lasers and catalysis due to their intrinsic properties. They are highly fluorescent, robust, photo-stable with tunable emission spectra and high quantum yield.[1] These unique optical properties of semiconductor QDs make them popular in biological investigations and multimodal imaging, in which traditional organic fluorescent labels fall short of providing long-term stability and simultaneous detection of multiple signals. On the other hand, combining Qd's with magnetic nanoparticles in a single material will allow the use of this multifunctional hybrid material for optical imaging as well as magnetic separation /imaging.[2]

High-quality semiconductor magnetic quantum dots of CdSe-Fe_2O_3 were normally synthesized in an organic phase with the presence of strongly coordinating hydrophobic organic ligands, such as trioctylphosphine (TOP) or trioctylphosphine oxide (TOPO). Reduction was carried out by trimethylamine-N-oxide. The synthesized magnetic QD's were further purified by magnetic harvesting. Absorption and fluorescence measurements showed narrow FWHM, acquired using a UV-Vis spectrophotometer /Photoluminescence (Molecular devices-spectra max M_2^e) respectively. Particle size of about ~20 nm was measured by transmission electron microscope (TEM). Quantum yield of about 45% were estimated by comparing the integrated emission intensity of QDs or MQDs to that of an organic dye (Rhodamine 6G) at the same optical density (0.1) and excitation wavelength (488nm). Later on, surface modication of MQD's by silica through reverse microemulsion strategy make them biocompatible and water soluble, which were then utilized for cellular uptake and live cell imaging in 3T3 and NIH cell lines.

In conclusion, we have synthesized multifunctional hybrid material which is highly reproducible and can be used for magnetic based separation, targeting and imaging.

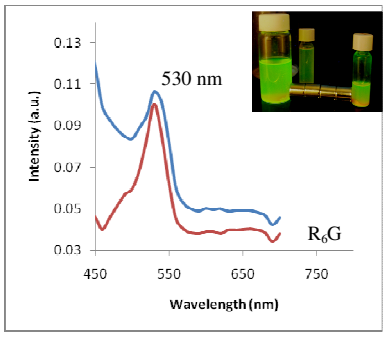

Figure 1 displays the absorption spectra of green colored MQD's (multifunctional nanocomposite)

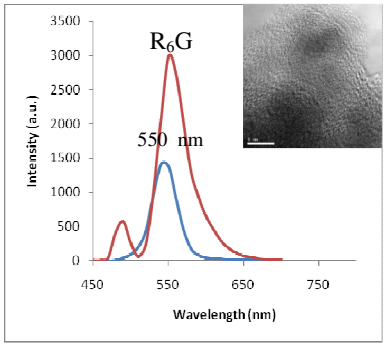

Figure 2 shows the emission spectra and TEM of green colored MQD (multifunctional nanocomposite)

References

[1] A. P. Alivisatos, Science 271 (1996) 933

[2] V. Roullier, F. Grasset, F. Boulmedais, F. Artzner, O. Cador and V.Marchi-Artzner 20(2008) 6657.