UPCONVERSION NANOPARTICLE-BASED FRET SYSTEM FOR OLIGONUCLEOTIDE DETECTION

Sonia Melle[1], Oscar G. Calderón[1], Marco Laurenti[2], Ana Egatz-Gómez[3], E. Cabrera-Granado[1], Alberto Villas[4], Elena Díaz[4], Diego Mendez-Gonzalez[2], Enrique López-Cabarcos[2] and Jorge Rubio-Retama[2]

1. *Departamento de Óptica, Facultad de Óptica y Optometría, Universidad Complutense de Madrid (UCM), Arcos de Jalón 118, 28037-Madrid, Spain*
2. *Department of Physical Chemistry II, Faculty of Pharmacy, UCM, 28040 Madrid, Spain*
3. *Center for Applied Structural Discovery, The Biodesing Institute, Arizona State University, Tempe, AZ 85287-5001, USA*
4. *GISC, Departamento Materiales, UCM, E-28040 Madrid, Spain*

*Corresponding author: oscargc@fis.ucm.es

Keywords: upconversion nanoparticles, Förster resonance energy transfer, biosensor

MOTIVATION Upconversion nanoparticles (UCNPs) have been proven to be promising candidates for detection of small oligonucleotides used as biomarkers in different diseases[1]. Our aim is to develop a Förster resonance energy transfer (FRET)-based nanosensor for detection of oligonucleotides. We study different nanoplatforms using UCNPs as donors, and quantum dots (QDs) or gold nanoparticles (AuNPs) as acceptors.

RESULTS We synthesized $NaYF_4$:Yb,Er nanoparticles coated with a silica shell and functionalized with amino groups. We employed steady-state and time-resolved fluorescence spectroscopic techniques to analyze the fluorescence quenching of the UCNPs in the presence of QDs[2] or AuNPs[3]. In the case of QDs, we study the distance dependence of FRET using UCNPs with different SiO_2 thickness. The FRET efficiency is shown in figure 1 (left panel). A Förster distance of 6.5 nm was obtained. In the case of AuNPs, we study the effect of the AuNP size on the fluorescence quenching. In figure 1 (right panel) we show the behavior of FRET efficiency when increasing the concentration of AuNPs.

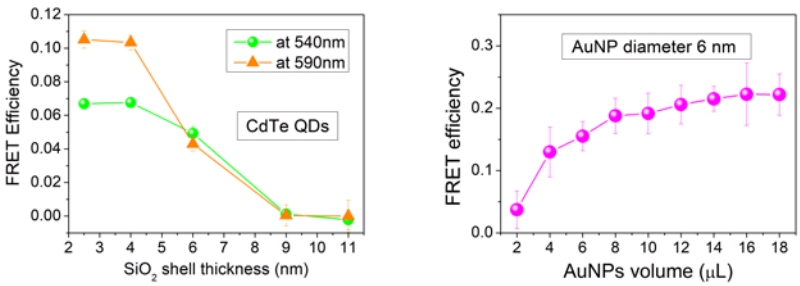

Figure 1. FRET efficiency of UCNPs in the presence of: CdTe QDs by varying the silica layer thickness (left panel), and AuNPs by increasing the concentration of AuNPs (right panel).

CONCLUSIONS The development of UCNP-based FRET systems for biosensing requires the optimization of the energy transfer between the donor-acceptor pair. We have optimized the FRET efficiency of UCNPs in the presence of QDs or AuNPs.

ACKNOWLEGMENTS This work has been funded by the Santander-UCM project PR26/16-12B.

REFERENCES [1] Mendez-Gonzalez, et al.; *ACS Appl. Mater. Interfaces.* **2017**, 9 (14), 12272, [2] Bednarkiewicz, et al.; *J. Phys. Chem C.* **2010**, 114, 17535, [3] Zhengquan, et al.; *J. Phys. Chem. C.* **2011**, 115, 3291.