Spring 2017 Colloquium Series

Department of Chemistry and Chemical Biology

Professor Thomas Hirsch

University of Regensburg (Germany)

Tuesday, April 25, 2017
11:00 AM, WL 260
Host: KiBum Lee

"Upconversion nanoparticles for lifetime – and intensity – based sensing applications"

Upconversion nanoparticles (UCNPs) represent a promising class of nanomaterials for bioanalytical applications due to their outstanding ability to convert near-infrared light into visible luminescence, enabling quasi-background free measurements, in conjunction with their multitude of narrow emission bands, high photostability, and chemical inertness.

The spectral overlap of the emission of UCNPs with the absorption band of coenzymes or co-factors of enzymes were exploited for the online measuring of L-lactate and glucose *via* an enzymatic related reaction. For this purpose, the particles and the enzymes were entrapped in a thin polyacrylamide hydrogel and put in a miniaturized flow cell. It is demonstrated that such a sensor can be used for longtime online determination of biomarkers.

Lifetime-based studies on UCNPs are advantageous in sensing applications as they do not rely on a defined particle concentration. By a study of in total eleven different, monodisperse, hexagonal-phase UCNPs with controlled diameters ranging from 10 nm to 42 nm the influence of the particle size on Förster resonance energy transfer (FRET) efficiencies was studied. Sulforhodamine B, rose bengal, and indocyanine green were chosen as model dyes to be combined with Yb/Er- and Yb/Tm-doped UCNPs. The FRET efficiencies of the dye-capped UCNPs were characterized with steady state and time resolved fluorometry. Successful FRET was demonstrated through the simultaneous reduction of the luminescence intensity and the lifetime of the respective upconversion emission bands. At optimized particle diameter and distance between the donor ions in the UCNPs and the surface bound acceptor dye molecules, FRET efficiencies up to 80% were obtained. Such particles are promising in theranostic applications, e.g. for photodynamic therapy.

If you would like to schedule a meeting with Professor Thomas Hirsch, please contact Robin Pacitti at 848-445-1554 or rp902@chem.rutgers.edu

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