

# **Seminář odd. 26**

## **Tenkých vrstev a nanostruktur**

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### **TÉMA**

## **Lanthanide and Nanodiamond for Future Luminescent Materials**

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Certain lanthanide ( $\text{Eu}^{3+}$ ,  $\text{Tb}^{3+}$  and several others) complexes are known to emit strong luminescence, which has distinct properties different from those of conventional organic dyes such as fluorescein; lanthanide luminescence has large Stokes shift ( $>200$  nm) with excitation in UV ( $\sim 350$  nm) and emission in Vis region ( $\text{Eu}^{3+}$  615 nm and  $\text{Tb}^{3+}$  545 nm), long lifetime more than 1 ms, and line-like sharp emission profile of FWHM of ca. 10 nm. The emission wavelength is specific to the central metal ion and is not dependent on the ligand. By taking advantage of long lifetime, time-resolved measurement of luminescence removes background fluorescence and enhances detectability of very small amount of antigens, DNAs, drugs, and other target molecules labelled with a lanthanide complex. This technology was applied to biotechnology for diagnostics by the author's group.

The author started research of detonation nanodiamond about 4 years ago, and found that with certain chemical treatment, the black nanodiamond can be converted into colorless transparent one. One reason that she started nanodiamond research is that it would be a good carrier of luminescent lanthanide complexes for bio applications. Design and synthesis of luminescent lanthanide complex labels for biomolecules are very difficult work, since the compound must satisfy several important requirements; compound must be soluble in water, the metal ion must stay stable in the metal-complex even in body fluid, and it must be stable against photo irradiation. Nanodiamond is water dispersible, non-toxic, and permeate cell membrane. If one can attach or make inclusion of lanthanide ion or compound on/in nanodiamond, that would reduce the labor of synthesis of lanthanide complexes, enhance stability and luminescence intensity, and alter lanthanide luminescence property. Even without lanthanide ion, colorless transparent nanodiamond itself is a fascinating research target.

odborný garant: *Ing. Štěpán Stehlík, PhD.*