Optical Quality Thin Films of Lanthanide Oxysulfides Nanoplates for Biosensing

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Nanosensors rely on an active layer supported on a conductive substrate. In its quest for diversification, this field is expanding its scope of building blocks, beyond the most traditional compounds such as ZnO, to incorporate new families of materials and capabilities. Amongst candidates, the family of lanthanide oxysulfide is still under-developed at the nanoscale, despite a range of potential applications in lightening technologies, sensing, photocatalysis and nanomedecine.[1] To explore their use as sensors, we developed a one-step synthesis for a family of nanoparticles with general formula Ln_2O_2S and versatile lanthanide composition.[2]

We showed that their bandgap is tunable based on the cation choice, from 2.1 eV for Ce_2O_2S to 4.7 eV for Gd_2O_2S.[3] From the colloidal suspension, we were able to produce thin films of optical quality by dip-coating, on hard (Si, FTO) and flexible (kapton) substrates. The film thickness was chosen from 10 to 135 nm by varying the withdrawal speed and by successive deposition of multiple layers.[4] As a proof of concept toward the development of biosensors, films deposited on FTO were used as electrochemical sensors to detect lipase enzyme.

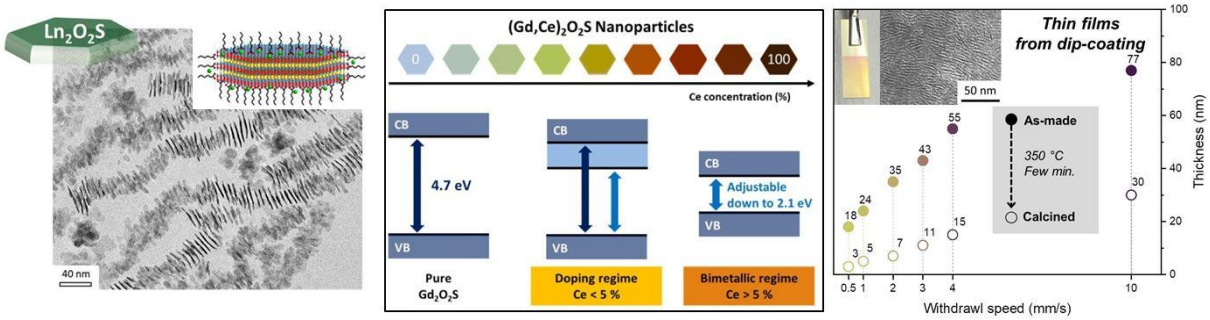

Figure: (Left) As-synthesized lanthanide oxysulfide nanoplates. (Middle) Tunable bandgap depending on the cation ratio (2.1 - 4.7 eV). (Right) Tunable thickness of the thin films.

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