

Layered double hydroxide nanotubes: a novel material and its applications involving luminescence

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Layered double hydroxides (LDHs) are a class of lamellar materials related to the sheet-like mineral brucite $Mg(OH)_2$. Isomorphous substitution of a fraction of the divalent metals by trivalent ones yields 2-d plates with general formula $[M^{II}_{1-x}M^{III}_x(OH)_2]^{x+}$ and residual electric charge. Intercalation of these plates with negatively charged ions keep the electrostatic balance in the material to form the flake-like LDHs. By tuning both the morphology and chemical composition of these materials, a vast range of functionalities has already been demonstrated for the LDHs, including applications as water-splitting catalyst, electrode material in Li-ion batteries, solid electrolyte, super capacitor or as sensitizer in photovoltaic devices. In this work, we show a novel nanotubular 3D mesostructured ZnAlEu LDH (Figure 1) capable of hosting anionic sensitizers (trimesate/1,3,5-benzenetricarboxylate) in the interlayer space, while the mesopores remain available for incorporation of additional photoluminescent systems [1]. Interaction of this material with CdTe quantum dots (QDs) shows high affinity of the QDs by the LDHs walls and presence of energy transference between Eu^{3+} and QDs (Figure 2) that can be further exploited for fabrication of nanothermometers, biological markers and sensors.

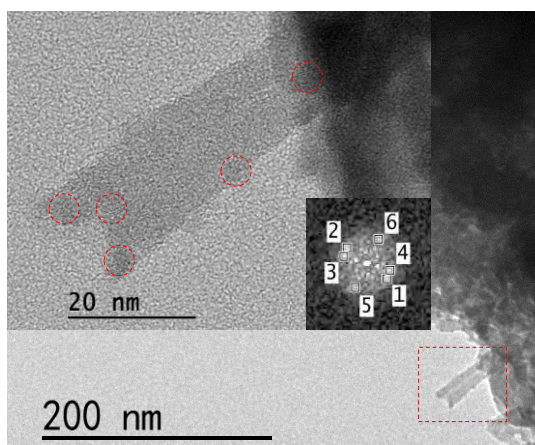


Figure 1 - Transmission Electron Microscopy micrograph of the LDH nanotubes decorated with CdTe@MPA QDs. The inset shows the Fourier transform in the region of the QDs.

4	0.3821	2.617	17.55	-17.40
5	0.3395	2.945	82.25	-117.19
6	0.3397	2.945	82.25	-117.19

Keywords: layered double hydroxides, nanotubes, quantum dots, LDHs.

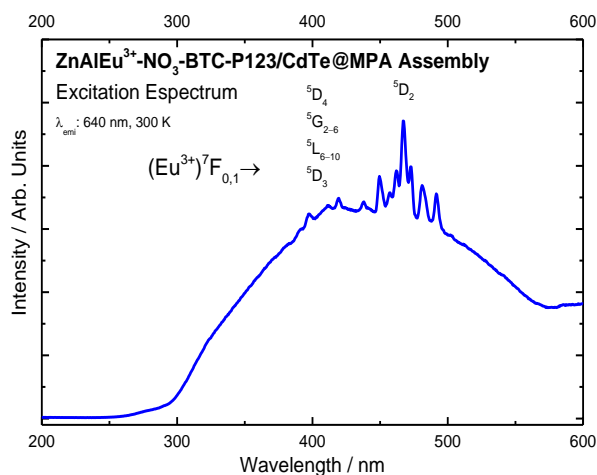


Figure 2 - Excitation spectrum of ZnAlEu-NO₃-BTC LDH nanotubes decorated with CdTe QDs monitored at the quantum dots emission at 640 nm, showing the contribution of the energy transfer between the nanotubes and QDs.

Acknowledgements

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References

[1] A. F. Morais, et al, "Hierarchical self-supported ZnAlEu LDH nanotubes hosting luminescent CdTe quantum dots", Chem. Comm. (accepted 2017).