Surfactant-free and green microfluidic synthesis of very small zinc sulfide nanoparticles for optical bioimaging applications

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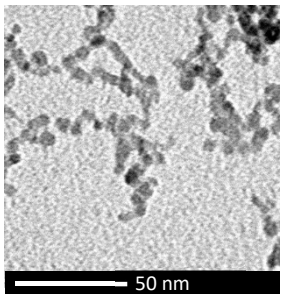
In recent years, microfluidic reactors have become highly attractive environments for synthesizing quantum dots of exceptional quality [1]. Two of the major benefits of using microfluidic systems to synthesize nanomaterials are (i) the rapid and continuous mixing of liquid precursors, that ensures the formation of homogeneous reaction mixtures on a millisecond time scale, and (ii) the ability to dynamically change reaction conditions such as reagent concentrations and reaction time. Thanks to these, microfluidic techniques allow a precise control over the final product. Moreover, microfluidic systems are easily scalable, ensuring, through “numbering up”, that the product’s features remain constant [2].

In this framework, the controlled, facile and green (in water and at room temperature) synthesis of pure and doped (with luminescent ions such as Mn^{2+}, Eu^{3+}, Sm^{3+}, Nd^{3+}, Yb^{3+}) ZnS nanoparticles with an average size of 5 nm was achieved via a microfluidic approach, without using any surfactant. The crystalline structure, size and morphology of the synthesized products were analysed employing XRD and TEM analysis (Figure), while the surface composition was determined by XPS. The luminescence and cytotoxicity properties of the synthetized doped ZnS nanoparticles were also studied in view of a possible application in the optical bioimaging field.



[1] Nightingale, A. M.; deMello, J. C. *Adv. Mater.* **2013**, *25*, 1806– 1806
[2] Elvira, K. S.; Solvas, X. C.; Wootton, R. C. R.; deMello, A. J. *Nat. Chem.* **2013**, *5*, 905-915