Microreactor assisted synthesis of nanoparticles for chemical analysis

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Metallic and photoluminescent nanoparticles (quantum dots and carbon dots) have drawn great attention over the last decades due to their potential applications in bioimaging or (bio)sensing. However, most of the conventional synthetic methods are limited due to the complexity of controlling size distribution and crystalline properties, thus making very difficult to achieve good reproducibility, which is crucial for analytical purposes. Microfluidic technology, based on the most common materials employed for miniaturization (glass, silicon or polymers), has been proposed to overcome these difficulties. Microfluidic platforms allow experimental variables such as temperature, flow rate and reagent concentration to be varied and controlled in a rapid, reproducible and precise way, which results in more uniform particles. The Sensors and Biosensors Group in the UAB has been working for more than ten years in the development of microreactors for the synthesis of colorimetric [1] and photoluminescent nanoparticles [2-4] based on the Low-Temperature Co-fired Ceramics technology (LTCC). This technology, based on green tapes, shows some very interesting advantages for this purpose such as high chemical and thermal stability. Moreover, the technology enables the construction of multilayered systems, which can integrate other mechanic, electronic, fluidic components and sensors in a single device without the need of sophisticated facilities and a rapid prototyping reduces significantly the cost and production time.
Different developed automatic microreactors, which integrate heaters, temperature sensors, microfluidics, optical windows and which allow the possibility of the in-situ optical control of the synthesis variables will be reviewed, taking emphasis on the characteristics of the obtained nanoparticles and their applications [5,6].

References

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Figures

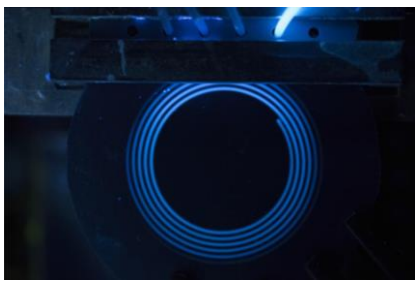

Figure 1: Example of the follow-up of the synthesis of carbon dots for heavy metals detection