**Femtosecond laser synthesis of luminescent graphene quantum dots**

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## Abstract

The discovery of graphene in 2004 [1] has stimulated the interest of all the scientific community due to its outstanding properties that make it one of the most promising materials to be employed in different application fields such as nanoelectronics, photovoltaic and so on [2]. Interestingly, the modification of graphene structure can be used for the design of fuel cells, organic light-emitting diodes (OLEDs) displays, and other devices.

Graphene quantum dots (GQDs) can be described as graphene sheets with dimensions less than 30 nm. Recently, the interest of researchers towards graphene quantum dots is growing due to their properties. In particular, their biocompatibility , luminescence and chemical stability make them suitable nanomaterials for the realization of devices for bioimaging and photovoltaic applications [3]. However, a straightforward and scalable method for large scale production of GQDs has not been reached so far.

In this study, we investigated the synthesis of graphene quantum dots by femtosecond laser ablation of graphene oxide dispersions. In particular, we found that the laser parameters, such as ablation time and laser power, play a key role in achieving a direct gram scale production of GQDs (Figure 1 a). HRTEM images showed that the average dimensions of the synthesized GQDs are 3-5 nm with a d-spacing of 0.21 nm (Figure 1 b), which is the value for a single layer of graphene [4]. Moreover, photoluminescence analysis revealed that the laser synthesized GQDs show blue luminescence emission at 410 nm. The mechanisms that may lead to the formation of these materials will be discussed as well.

## References

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## Figures

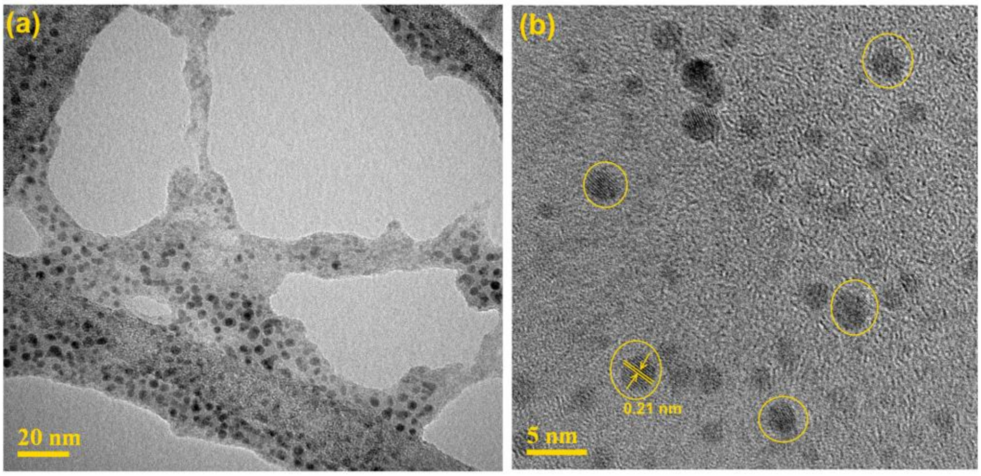


**Figure 1: (a) TEM image of GQDs synthesized by femtosecond laser ablation of graphene oxide dispersion; (b) HRTEM image of GQDS showing a d-spacing of 0.21 nm.**