Graphene Quantum Dots Produced by Microfluidization

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Abstract

The unique physical properties of graphene quantum dots, including their controllable photoluminescence, flexible structure, biocompatibility and photostability, make them highly desirable for novel applications, such as flexible photovoltaics and bioimaging.

However, the commercialization of these next–generation quantum dots is limited because their production is highly complex and costly. Here, we present for a first time, a purely mechanical method for top-down fabrication of graphene quantum dots.

During a microfluidizer-based "top-down" fabrication, millimeter-sized graphite flakes are fragmented into zero-dimensional nano-sized dots due to high shear rates (>10^7 sec-1) generated by pressurizing the graphite-aqueous suspension through micro-sized channels. The as-prepared GQDs are non-functionalized and exhibit excitation-independent photoluminescence.

This facile, environmentally friendly, and scalable method provides an ideal framework for substantial progress toward large-scale production and commercialization of GQDs-based applications.

References

[1] Buzaglo, M.; Shtein, M.; Regev, O., **Graphene Quantum Dots Produced by Microfluidization**. *Chemistry of Materials*, **28** (*2016*), 21-24

Figures

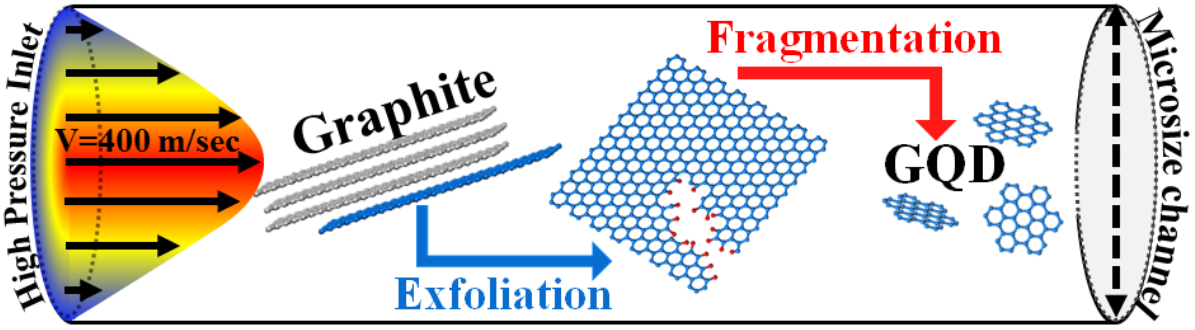

Figure 1 - Typical flow profile within the channel with maximal flow speed of 400m/s. The graphite flakes are exfoliated into graphene sheets and further fragmented into nanosized graphene quantum dots.