Microfluidic Devices: A Tool for the Preparation of Graphene and Derived Fibers

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Abstract
Since graphene was discovered in 2004, has been attracted the attention of many researchers, due its outstanding electrical, mechanical, thermal and optical properties. Based on that, graphene and its derivatives, like graphene oxide (GO) and reduced graphene oxide (rGO), have been touted as a candidate for development of microfibers, due its superior properties in relation of the conventional carbon fibers [1]. However, the biggest challenge resides in preparing the graphene fibers in a scalable way and keeping its unique properties. In this way, it is crucial the development of new technologies to overcome these difficulties. Herein we address the manufacture of a 3D flow focusing microfluidic device, based on the LTCC (Low Temperature Co-Fired Ceramics) technology, aiming to developed graphene oxide fibers. The devices were manufacture using green ceramic foils from DuPont. The GO sheets were obtained by the Hummer´s method [2] and characterized by Raman spectroscopy. In the core flow of the microfluidic device, GO dispersion was inject, and in the co-axial flow, an aqueous solution of CTAB 0.05 % w/v was used as coagulant agent for the formation of GO fibers. The Figure 1 shows the optical image of the GO fiber that has been developed by this work. Based in our preliminary results the 3D flow focusing microfluidic device is an interesting tool to achieve the control of thickness of the GO fibers and orientation of the GO sheets, thus improving the mechanical and electrical properties of the fibers.

References

[1]– XU, Z.; GAO; C. Graphene Fiber: A New Trend in Carbon Fibers. Materials Today, v. 18, N.9, p. 480-492, 2015.
[2] HUMMERS, W. S.; OFFEMAN, R. E. Preparation of Graphitic Oxide. Journal of the American Chemical Society, v. 80, N. 6, p. 1339, 1958.

Figures

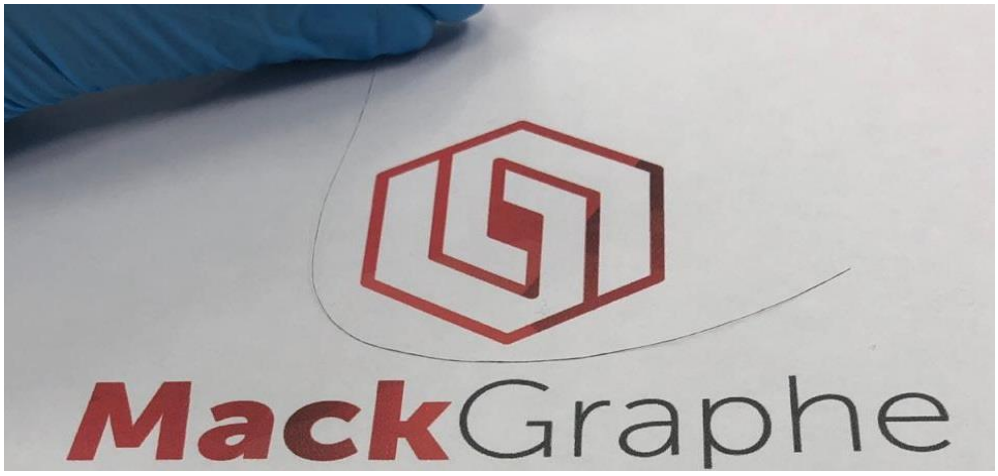

Figure 1: Graphene oxide fiber prepared by the microfluidic device.