Laser-Induced Graphene Microsupercapacitors: Exploring its Structure, Quality, and Performance

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In this work, we present a comprehensive study of laser-induced graphene (LIG) material fabricated on 60 µm polyimide films under eight different infrared laser conditions (CO_2, 10,6 µm) [1]. Its potential as microsupercapacitor electrodes has been tested by correlating microstructure (by scanning electron microscopy) and material quality (by micro-Raman spectroscopy mapping) to its final electrochemical performance. At 2 W of laser power and 45 mm/s scan speed, the pyrolysis process produces a high-quality multilayer graphene material, with homogeneous microporosity accessible to the electrolyte (Fig. 1). LIG microsupercapacitors were fabricated as two symmetric interdigitated electrodes and assembled with 1M H_2SO_4 PVA-based gel electrolyte. Thorough electrochemical testing reports a high capacitance of 22.2 mF/cm^2 at 0.05 mA/cm^2, with energy and power densities comparable to similar devices in the literature, including even those produced with pseudocapacitive materials.

References

[1] A. Velasco, Y. K. Ryu, A. Hamada, A. de Andrés, F. Calle, and J. Martinez, *Nanomaterials*, vol. 13, no. 5, (2023), p. 788.

Figures

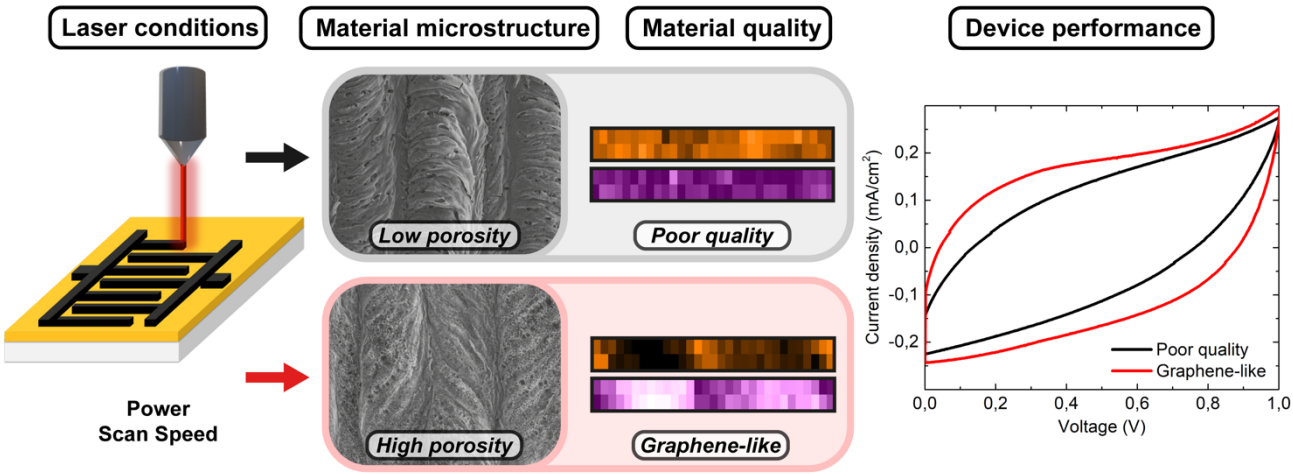

Figure 1: (left) Schematic drawing of the laser pyrolysis process. (centre) SEM and RAMAN characterisation of LIG material from two different laser conditions. Orange represents ID/IG peak ratio (darker is better) and purple represents I2D/IG peak ratio (lighter is better). (right) Comparison of the cyclic voltammetry tests (at 0,02 V/s) of these two microsupercapacitors.