Electronic properties and electrochemical applications of UV irradiated fluorinated graphene films

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The development of electronic devices has increased necessity of high power micro-supercapacitors. Graphene materials have been ideal material platform for constructing flexible electronic; its 2D structure, high specific area and good conductivity are attractive for energy storage devices. The fluorinated graphenes with composition C_2F were synthesized using low temperature fluorination by BrF_3 from natural graphite. Suspension of fluorinated graphite in toluene was used to produce films having a thickness of 1 - 10 μm. The UV radiation treatment of film surface performed local conversion of fluorinated graphene to graphene. Depending on irradiation conditions, it is possible to vary functionalization degree of the resulted graphene material. The almost complete defunctionalization (98 % of carbon) of surface layer of films was achieved using focusing radiation of low power laser (λ = 380 nm). Produced electrode material with high electrical conductivity and flexibility is useful for energy storage devices without binders or conductive additives. We reveal an influence of structural features and functional composition of graphene material on electrochemical performance of in-plane microsupercapacitors. Pattern of microelectrodes was drawing by UV laser and supercapacitors properties of these elements were measured for different acid electrolytes (Fig. 1). Obtained materials showed tunable electrochemical performance, which reaches 1.5 mF/cm^2 at rate 0.8 mV/s. The change of chemical states of capacitor surface under electrical charging was controlled by XPS and NEXAFS *in situ* measurements. We reveal an influence of structural features and functional composition of graphene material on electrochemical performance of in-plane micro supercapacitors.

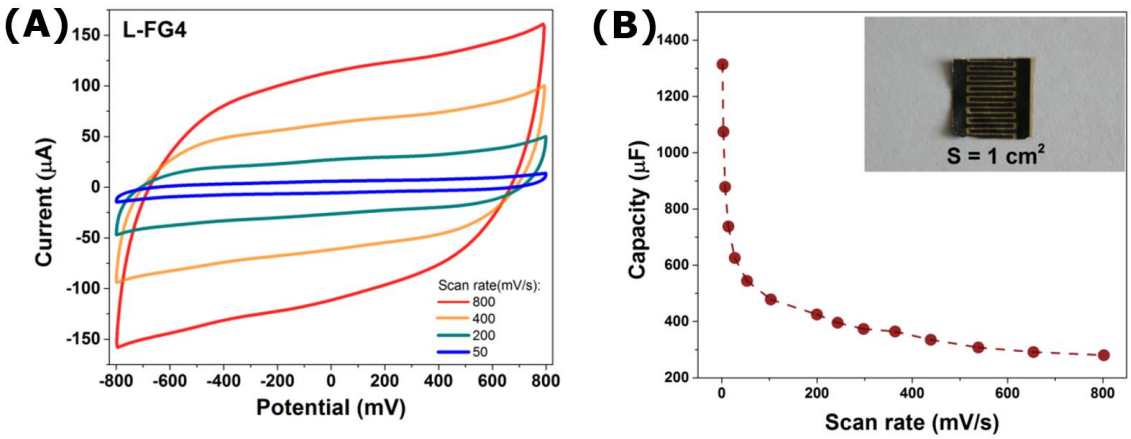

Fig. 1. Electrochemical characterization of LFG-MSC with interdigitated electrodes. (A) CV curves obtained at different scan rates. (B) Evolution of area capacitance versus scan rate. Inset shows optical photography of device.