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SYNTHESIS AND CHARACTERIZATION OF NITROGEN MODIFIED REDUCED GRAPHENE OXIDE

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The successful application of reduced graphene oxide (rGO) in supercapacitors, (bio)sensors, fuel or solar cells strongly depends on its physicochemical properties. Recent research suggests that introducing heteroatoms (B, N, P, S) into rGO can significantly modify its electrochemical, electronic, and structural characteristics [1,2]. It is well known that nitrogen-rich sites in rGO can notably improve electrochemical activity, especially, in the presence of pyrrolic-N and pyridinic-N bonding configurations. N-doping also increases the electrical conductivity of graphene-based materials due to the formation of N-graphitic atoms in the lattice and enhances the specific surface area by larger defect sizes and a more porous structure [2]. In the case of B-doping, incorporating boron can create additional sites on the carbon surface, enhancing both hydrophilicity and material durability [3]. Consequently, the B- and N-codoped rGO (BN-rGO) samples synthesized with improved structural and electrochemical properties show promise as cost-effective and metal-free electrode materials for supercapacitors or (bio)sensors. This study focuses on the synthesis process and characterization of BN-rGO nanostructures. BN-rGO samples are prepared by a two-stage synthesis method: initially, a hydrothermal treatment of a graphene oxide/NH_4BF_4 mixture at 180 °C temperature for 20 hours, followed by thermal annealing in a tube furnace at 850 °C temperature for 30 min under Ar atmosphere. Various techniques, including scanning electron microscopy, transmission electron microscopy, energy dispersive X-ray spectroscopy, Raman spectroscopy, and nitrogen adsorption-desorption isotherms at 77 K, are used to analyze the impact of B- and N-incorporating on morphology and structure of rGO.

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