Carbon nanotube buckypaper, reduced graphene oxide and polypyrrole nanocomposites for supercapacitor applications.

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Due to their high power, charging rate, low weight and durability supercapacitors have become effective devices for energy storage. Through these advantages they can be widely used in pulse electronics, such as photoflash tubes, pulse lasers, etc., as well as electric vehicle supply systems. Charge accumulation in supercapacitors is accounted for two processes: double electric layer formation, formed on the electrode surface–electrolyte interface, and redox (reduction – oxidation, so called Faraday) reactions procedure. Typically, carbon materials, conducting polymers, transition metals oxides and composites based on them are the materials for supercapacitors. Carbon materials mainly accumulate energy due to the double electric layer foundation. Thus, their advantages are large surface area, high conductivity and cycling stability. Conducting polymers and transition metals oxides basically accumulate energy through the Faraday reactions, they possess more capacities, but lower chemical stability in comparison with carbon materials. Thus, derivatization of the composites that combine the carbon template and electrically active conducting polymers properties has shown the promising applications in high-effective electrode supercapacitor materials production.

In our work we synthesized buckypaper based on multiwall carbon nanotubes and reduced graphite oxide, later used as carbon template. Further, chemical and electrochemical deposition of polypyrrole was carried out on the carbon material electrodes. To study the morphology and functional composition of obtained products we used SEM, IR-spectroscopy, XPS and Raman spectroscopy methods. Cyclic voltammetry and electrochemical impedance spectroscopy methods were used to investigate electrochemical behavior of the samples.

We also studied the influence of carbon template and polypyrrole deposition methods on their morphology and electrochemical properties. Carbon nanostructures specific capacity was shown to increase after polypyrrole deposition, reaching 200 F/g, since the materials demonstrated high stability during the cycling process.

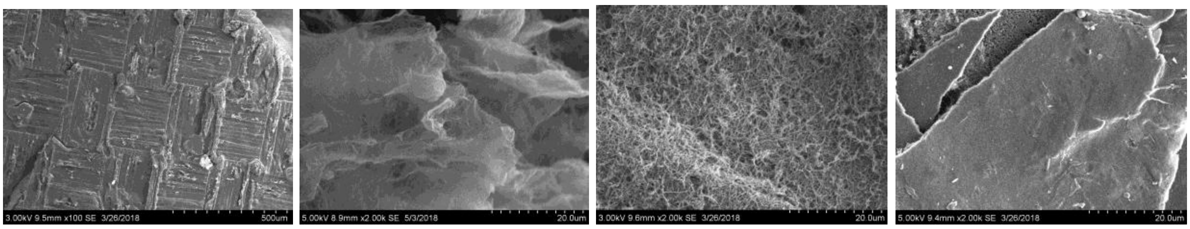

Fig 1. *SEM images of carbon material and their composite with carbon material: a) carbon nanotube buckypaper; b) reduced graphene oxide; c) composite of buckypaper with chemical precipitated polypyrrole; d) composite of buckypaper with electrochemical precipitated polypyrrole.*

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