

ABSTRACT OF PhD THESIS

„Preparation and characterization of graphene and graphene / metal oxide nanocomposites“

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The subject of the research performed in the frame of this dissertation dealt with carbon materials and graphene/metal oxide composites. Carbon materials were obtained as a result of oxidation and ultrasonic homogenization processes of multi-walled carbon nanotubes. The oxidation processes of MWCNTs were carried out using two methods and different oxidizing agents. In the first case, concentrated sulfuric (VI) acid was used, while in the second, a mixture of concentrated sulfuric (VI) and trifluoroacetic acids was applied. Various methods were also used to terminate the oxidation reaction.

The main objective of the doctoral dissertation was to study the influence of synthesis process parameters on the morphology, structure and properties of obtained carbon materials. The second objective was to modify the surface of carbon materials by doping them with metal oxides and testing the resulting composites for thermal, electrical and magnetic properties. The materials were obtained by two solvothermal methods: using a microwave reactor and a pressure autoclave. Depending on the process parameters (time, temperature and pressure), hybrid composites with different surface and content of components were obtained. The type of the applied method influenced the properties of the obtained composites.

The first part of the dissertation contains a literature data review in which the most important issues related to graphene are presented. This part comprises a basic knowledge about the history of graphene, its production methods, properties and applications. The current state of knowledge of graphene/metal oxide composites is presented. The analytical methods used in the research work are described.

The experimental part of the dissertation discusses the processes of obtaining carbon materials and graphene/metal oxide composites, followed by a description of the methodology of experimental research and the obtained results. The presented studies concerned the impact of the carbon material synthesis method and the type and concentration of dopant on the structure and properties of the obtained composites.

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