The aim of the submitted project is to control the synthesis of graphitic materials characterized by increased hydrogen sorption capability. The starting material for the formation of above mentioned materials will be electrochemically prepared graphite oxide (EGO). Owing to the fact that electrochemical methods ensure high control of the conducted processes, the synthetized graphite oxide will be characterized by the well defined structure as well as chemical contents hence planned properties. On further investigations, the electrochemically prepared graphite oxide will be subjected to chemical overoxidation by Hummers method. GO will be characterized by the enhanced concentration of oxygen functional groups accompanied by the enlarged interspace between the graphene layers. The such prepared graphite oxide will be used as a matrix for intercalation of the selected organic compound. Product of this process will be denoted as graphite oxide intercalation compound (GOIC). The aim of this part of the planned investigations will be modification of interlayer space within the chemically overoxidized EGO leading to the improvement of its hydrogen sorption capability. An intercalation of organic compounds into the GO allows the formation of material characterized by the well defined pore size, so called graphene oxide frameworks (GOF). The purpose of successive investigations within this project will be synthesis of the reduced graphite-metal oxide composites (RGO-M). The reduction of GO commonly leads to removal of oxide functional groups from graphene layer, in consequence, the concentration of surface defects increases. These defects may play a role of active centers being active during the process of hydrogen electrosorption. The one-step process of GO reduction will be performed by electrochemical methods with simultaneous metal deposition from the electrolyte in which the process will be conducted. Among the metals being deposited onto the surface of graphite oxide will be nickel, palladium and ruthenium, which are recognized as catalyst for hydrogen evolution and sorptionTill now, in literature there is no information on electrochemical reduction of GO accompanied by the metal deposition, so it seems that the such prepared composites successfully used for hydrogen electrosorption will be described in our project for the first time. The control of electrochemical processes can be achieved by the applied potential (potentiostatic methods) and passing current (galvanostatic methods), therefore the chemical content of reduced GO surface and the amount of metal deposited will be controlled by the conditions of performed process. These information encourage us in statement that the synthetized graphitic materials will exhibit properties appropriated for effective hydrogen sorption. Additionally, it is assumed that prepared graphite materials in an appropriate manner described and characterized, in the future, may be considered as interesting materials with a wide practical use in many areas of life and science.