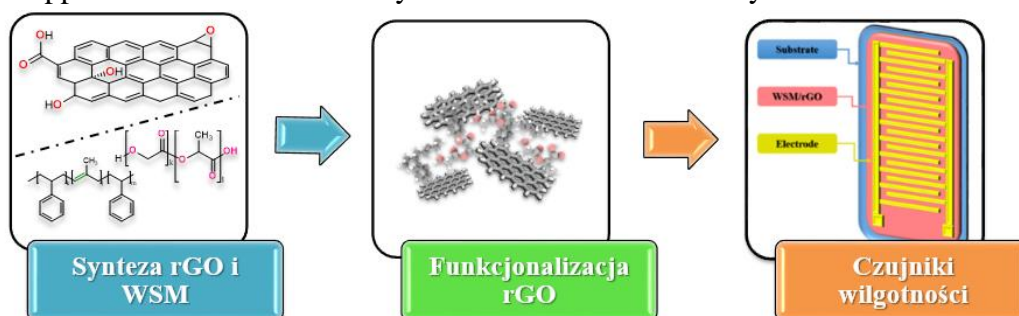


Research project objectives

The aim of the project entitled "New generation of humidity sensors concern functionalized graphene-based materials" is to functionalize graphene-based materials with synthesized and characterized polymer composites that swell when exposed to water. The prepared hybrids will be used to develop a new generation of humidity sensors, the functionality of which will exceed the current commercial sensors. The project involves the performance of the following tasks:

- 1) Development of efficient and reliable methods for the controlled reduction of graphene oxide (GO) and synthesis of water-swelling materials (WSM).
- 2) Determining which WSM and reduced graphene oxide (rGO) have the best properties from the point of view of the humidity sensor system (high porosity, swelling capacity in water)
- 3) The application of the obtained hybrid materials as a humidity sensor.



Research description

The project involves the design of a high-efficiency method of GO reduction, WSM preparation and the synthesis of hybrid materials. The reducers used in the GO reduction process were selected based on the principles of green chemistry. WSM will be prepared using two methods to obtain the best properties. Additionally, the project also provides for the synthesis of new hybrid materials that will be implemented in the humidity sensor. Each stage of the project will be supported by an appropriate analysis and methodology used in chemical sciences. The research is interdisciplinary, combining elements of organic synthesis, materials chemistry and electrochemistry. Moreover, the project is a continuation of the international cooperation of the University of Adam Mickiewicz with the prestigious Institut de Science et d'Ingénierie Supramoléculaires (ISIS) belonging to the University of Strasbourg in France.

Research project impact

Currently used humidity sensors based on ceramics (in particular Al_2O_3 and Si_3N_4), metal oxides such as SnO_2 have many limitations including long response time, poor regeneration and low sensitivity to water molecules. Therefore, new solutions are investigated which will be able to provide demands. In recent years, rGO has become interesting choice for researchers due to good electrical conductivity, large specific surface area and porosity. However, rGO has a hydrophobic nature because of lack of oxygen functional groups in the structure. This property causes limits the possibility of non-covalent interaction with water molecules, which results in the low sensitivity of rGO-based sensors. The project provides for the improvement of sensitivity through the addition of WSM to working device. WSM are characterized by a large change in volume under the influence of water molecules. The synthesis of hybrids on the basis of rGO and WSM will allow to combine the properties of these materials and use their potential as humidity sensors. The designed new generation of sensors will surpass current solutions. Moreover, the project will expand knowledge about the reduction of graphene oxide, preparation of water-swelling materials and synthesis of rGO-WSM hybrids.