Synthesis of multifunctional few layers graphenes for different applications

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Metal-organic frameworks (MOFs) - attract a lot of interest as potential energy materials, because of their high density and high heat of detonation. The porous crystalline structure attracts attention due to its high specific surface characteristics and the possibility of changing their physicochemical properties by introducing metal centers. A method for synthesizing multilayer graphene oxide frameworks (GOFs) from vegetable wastes such as rice husks or walnut shells has been developed.

In the past years, there has been an interest on the investigation of two-dimensional carbon nanomaterials with atomic level thickness. As the top of this family, graphene has received considerable attention due to its unique electrical, mechanical and photothermal properties, and a variety of applications have been proposed in molecular devices, material and life sciences. To realize these applications, scalable graphene production and subsequent sample engineering play a key role.

In this work, graphene layers were obtained from rice husk by potassium hydroxide activation followed by alkaline desilication. Rice husk samples was subjected to carbonization at the following conditions: 2 h of activation time, 850 ºC and ratio of rice husk/KOH (wt/wt) was 1/4. Concentration of NaOH desilication solution was 1M. The obtained samples were studied using Raman spectroscopy, the peaks characterize the presence of graphene layers in the sample. The yield of the product was ~ 3 % by weight.

Rice husk (RH), which is a multi-tonnage and renewable waste, was used as a raw material. KOH is used as a typical chemical reagent to induce porosity. The carbonized rice husk containing graphene was obtained in four successive stages: pre-carbonization, desilication, chemical activation and exfoliation of the carbonized rice husk (CRH).

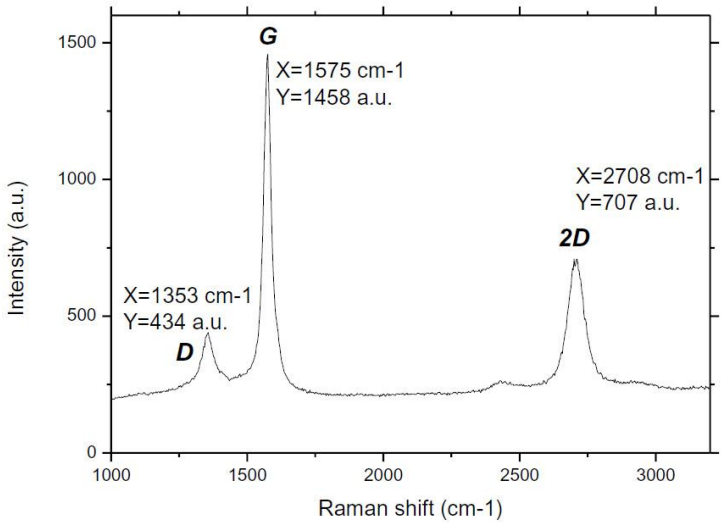

Fig. 5 Raman spectrum of a multilayer graphene and SEM microimages of the graphene film.

The use of grapheme oxide structures as energy-intensive additives can become one of the promising ways to improve the efficiency of high-energy rocket fuels. It has been established that

graphene oxide structures, depending on the concentration of 1-5 % of the total mass, promote the convective combustion rate of hydroxylammonium nitrate An increase in the linear combustion speed of hydroxylammonium nitrate to 400 mm/s (initial pressure of 6 MPa) and the ability to reduce the required initial pressure to 1 MPa are established to provide self-sustaining combustion conditions with the addition of GOFs based on rice husks (1 % of the total mass).

On the basis of experimental results, it was found that the addition of 1 % GOFs affects the rate of evaporation of water droplets and methanol in the form of a reduction in the evaporation time of droplets for both liquids by 30 % and a decrease in the boiling point of the liquids. On the basis of these data, it is possible to develop a method for purifying sewage from various toxic metal salts that precipitate.

Fig. 5 shows Raman spectrum of graphene layers obtained from CRH, the maximum number of graphene layers is less than ten (I_G/I_{2D} = 2.06 and I_D/I_G = 0.29), as indicated by the ratio between the peaks' intensities I_G/I_{2D}. It was shown that the ratio of I_G/I_{2D} = 1.3 corresponds to three layers of graphene, whereas the authors of found that I_G/I_{2D} = 1.8-2.4 corresponds to 5-10 layers of graphene.

These materials can be used as supercapacitor electrode materials and desalination of water. Abundant low-cost rice husk was used as the carbon source to prepare the nanostructared carbon based electrodes. The specific capacitance of this carbon material was 254 F/g for a scan rate of 1 mV/s in 6 mol/L KOH electrolyte, which is superior to those of other reported carbon based materials. The supercapacitor demonstrated good electrochemical performance and stability.