Graphene materials for energy storage: Synthesis of graphene oxide with different degrees of porosity

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Graphene materials are highly versatile because they can be obtained in the form of films[1, 2], fibers[3] or three-dimensional structures[1], and they are lightweight and have high specific surface area (SSA) and porosity. This makes them potential candidates for applications that require these properties, such as supercapacitors[1, 4], water decontamination[2], hydrogen storage[5] or capturing of radioactive elements[6]. Each of the targeted applications has different SSA and porosity requirements. Most of the chemical syntheses used to obtain these materials start from graphene oxide (GO) as the initial reagent. The objective of this study is the synthesis of GO with different degrees of porosity, by creating holes of different sizes on its sheets for its subsequent use in the synthesis of three-dimensional graphene structures with the desired porosity according to the application. For this purpose, an optimization of a hydrothermal process has been carried out where H_2O_2 has been used to create the holes in the GO sheets [3, 4]. The different variables that influence the hydrothermal process (temperature, time, amount of H_2O_2 and GO concentration) have been optimized by applying an experimental design and all the materials obtained have been characterized by X-ray diffraction (XRD), Brunauer-Emmett-Teller (BET), Elemental Analysis (EA), Raman and Scanning Electron Microscopy (SEM). In this way, the necessary experimental conditions have been established to achieve the desired porosity in the starting GO according to the application.

References

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Figures

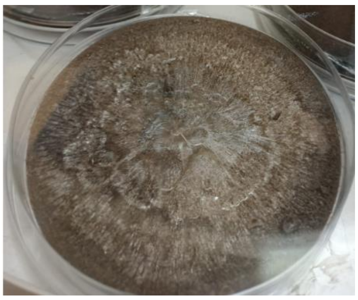

Figure 1: GrO treated with H2O2 and freeze dried