

Modification of Graphene Oxide as Catalyst Support for Fuel Cells

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Abstract

Graphene is an increasingly important material with distinct properties such as high electrical conductivity, high contact surface area and enormous stability. Therefore, graphene has been used as a promising catalyst support in energy conversion and storage systems. In order to achieve high catalytic activity a specifically guided growth of catalyst on graphene support surface with delicate controllability is highly preferred. Therefore, we modify graphene surface in two different ways such as graphene functionalization with various active functional groups and fabrication of nanocomposites with intrinsically conducting polymers e.g. polypyrrole (PPy). The functionalization of graphene oxide has been carried out with different types of functional groups such as APTS-NH₂, APTS-OCH₃, p-phenyl-NH₂, n-phenyl-p-phenyl-NH and N-doped by annealing GO with NH₃. FTIR and Raman structural analysis evidenced the successful functionalization with the corresponding chemical moieties. The catalyst nanoparticles deposition on these functionalized GO and their electrochemical activity will be presented. In another approach of graphene modification, PPy nanocomposites are fabricated *in-situ* in the presence of GO, carbon black (CB), graphene quantum dots (GQD), and their hybrids. The introduction of GO, CB and GQD has a great effect on the morphology of the nanocomposites and the size of PPy nanoparticles. The FTIR and Raman structural analysis were evidenced the successful incorporation of polypyrrole nanoparticles into the carbeneous materials including GO, CB and GO/CB hybrids. Thermogravimetric analysis (TGA) indicated that the GO/CB/PPy hybrid exhibited high thermal stability compared to neat composites. The SEM images showed different particle size and distribution behavior of PPy during the formation of nanocomposites in the presence of the type of carbeneous material used, GQD, GO, CB, and their hybrids. It is worth pointing out that the size of PPy nanoparticles has reduced by the increasing amount of carbon filler in the composites from 5 wt% to 15 wt% with respect to pyrrole monomer. The difference in the PPy nanoparticles distribution on the carbeneous surfaces may significantly influence their properties such as electrical conductivity, electrocatalytic activity when they used as catalyst support and etc will be discussed more in details.

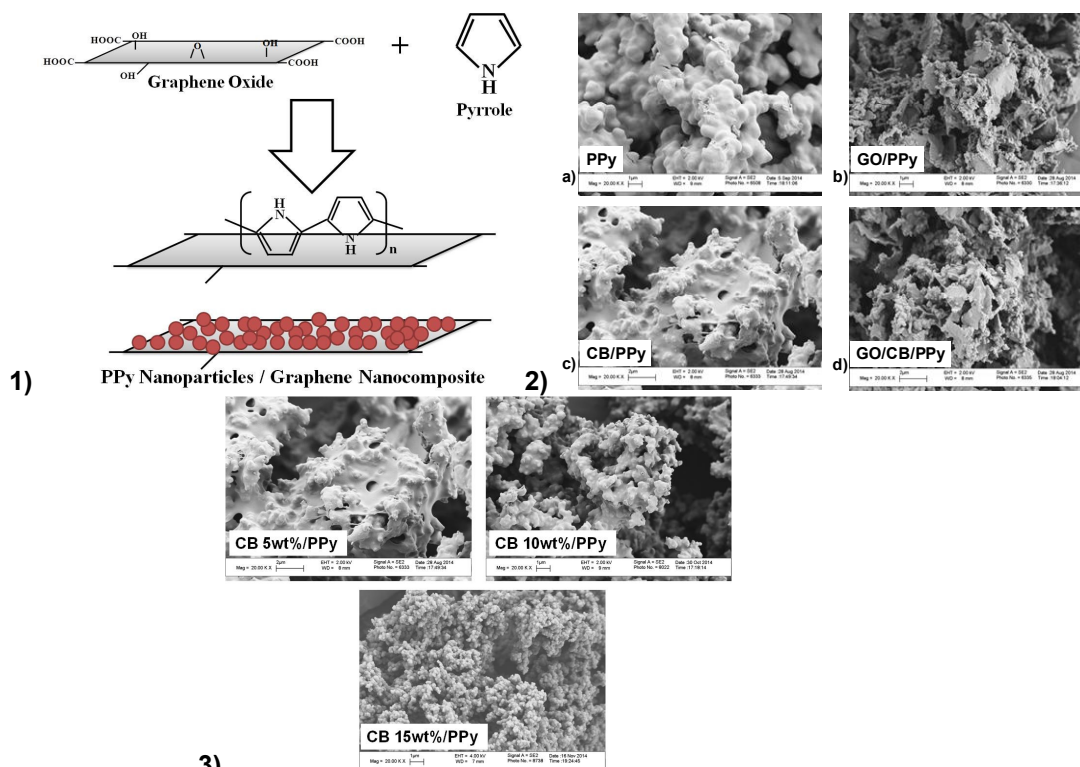


Figure. 1) Schematic representation for GO/PPy nanocomposites *in-situ* fabrication, 2) SEM images of nanocomposites with 5wt% GO, CB and GO/CB, 3) SEM images of CB/PPy with increasing CB content.