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Synthesis and Characterization of the Carbon Spheres Built Up from Reduced Graphene Oxide

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Abstract : The ordered structural carbon (OSC) material is expected to apply to the electrode of secondary batteries, the catalyst supports, and the biomaterials because it shows the low substance-diffusion resistance by its uniform pore size. In general, the OSC material is synthesized using the template material. Changing size and shape of this template provides the pore size of OSC material according to the purpose. Depositing the oxide nanosheets on the polymer sphere template by the layer by layer (LbL) method was reported as one of the preparation methods of OSC material. The LbL method can provide the controlling thickness of structural wall without the surface modification. When the preparation of the uniform carbon sphere prepared by the LbL method which composed of the graphene oxide wall and the polymethyl-methacrylate (PMMA) core, the reduction treatment will be the important object. Since the graphene oxide has poor electron conductivity due to forming a lot of functional groups on the surface, it could be hard to apply to the electrode of secondary batteries and the catalyst support of fuel cells. In this study, the graphene oxide wall of carbon sphere was reduced by the thermal treatment under the vacuum conditions, and its crystalline structure and electronic state were characterized. Scanning electron microscope images of the carbon sphere after the heat treatment at 300ºC showed maintaining sphere shape, but its shape was collapsed with increasing the heating temperature. In this time, the dissolution rate of PMMA core and the reduction rate of graphene oxide were proportionate to heating temperature. In contrast, extending the heating time was conducive to the conservation of the sphere shape. From results of X-ray photoelectron spectroscopy analysis, its electronic state of the surface was indicated mainly sp^2 carbon. From the above results, we succeeded in the synthesis of the sphere structure composed by the reduction graphene oxide.

Keywords : carbon sphere, graphene oxide, reduction, layer by layer
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