

Solvothermal Synthesis of Carbon Nanostructure by the Reaction of Benzene and Ferrocene

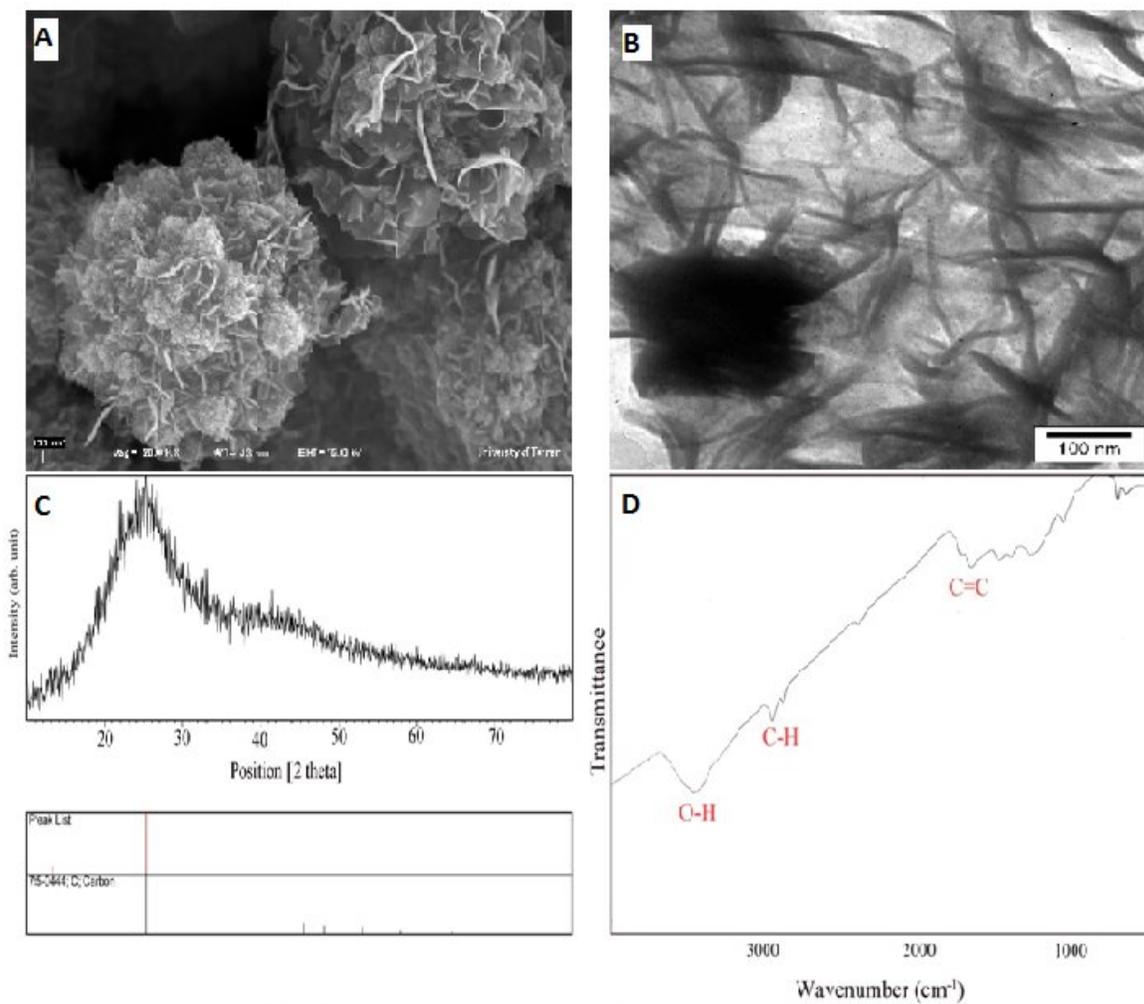
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Carbon nanomaterials are essential in applications for adsorbates, optical devices, nanoreactors, electrochemical supercapacitors, and storage materials. They have superior physical and chemical properties, such as thermal conductivity, electric conductivity, chemical stability, low density and availability. Considerable efforts have been made to study the preparation and growth mechanism of carbon nanostructure. Various methods were demonstrated for the synthesis of carbon nanostructure, such as catalytic pyrolysis, plasma radiation, chemical vapor deposition (CVD), electric arc evaporation, and laser ablation of carbon. However, these methods have limitations in terms of large-scale and economical production because of their harsh synthesis conditions, low production yields and expensive instruments. Recently, many efforts have been devoted to the synthesis of carbon nanostructures under solution phase. In previous solvothermal researches for synthesis carbon nanostructures higher temperatures were used.

We were interested in the synthesis of nanostructures via solvothermal method for a few years. In this study, we report a relatively low temperature solvothermal method for synthesizing carbon nanostructure by the reaction of benzene and ferrocene. In this process, benzene was used as carbon source and solvent simultaneously. Nanostructures were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), Fourier transform infrared (FT-IR) spectroscopy, energy-dispersive X-ray (EDS) analysis and atomic force microscopy (AFM). The purity of nanostructures was also confirmed by EDS analysis, where lines of C are observed. The appearance of S and Fe in the EDS signals is due to the catalyzer. An absorption peak was occurred in the 2920 cm^{-1} that is related to stretching vibration of C-H. Absorptions at 1624 cm^{-1} is attributed to C=C bond. A broad peak at 3430 is related to O-H bond adsorbed on the carbon nanostructure, so carbon was synthesized without IR-active impurities. TEM image of carbon nanostructures is depicted in Fig. 1 that particularly nanorods are observable and obviously approve the thickness of nanostructures is less than 20 nm.



A)SEM, B)TEM, C)XRD, D)FT-IR

Fig. 1.