Water-soluble hat-stacked-type carbon nanofibers for biomedical applications

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Nanocarbon materials have been widely studied as catalyst supports in heterogeneous catalysis because of their unique morphology and reactivity[1]. Recently, a novel type of carbon nanofiber exhibiting cup-stacked morphology was developed as a unique and functional "tubular" nanosized materials[2]. Generally speaking, the morphology of carbon nanofibers is dependant on the metal catalyst. We have synthesized the carbon nanofibers with the structure in which graphene-hats are stacked toward a needle-axis. Here, we call these "Hat-stacked-type carbon nanofibers (Hat-stacked-type CNFs)". As the edges of the graphene-hat have been exposed, many hydrophilic groups can be added in order to dissolve them into water and to use them biomedical application such as a carrier of DNA transduction. Also, as each hat is van der Waals force in which binding force is weak, hat-stacked-type CNFs can be cut off, that is, it is possible to control their length size. Thus, hat-stacked-type CNFs can be expected as a biomaterial as well as carbon nanotubes[3-6].

In this presentation, we report simple cutting and water-solubilization of the hat-stacked-type CNFs using sonication in a mixture of concentrated acids[7]. We purified the hat-stacked-type CNFs (Figure 1) and characterized the cut hat-stacked-type CNFs by SEM, TEM, XRD, and FT-IR measurements. The hat-stacked-type CNFs were easily cut into 400-nanometer to 1.5-micrometer lengths, and the cut nanofibers formed a stable solution in water.

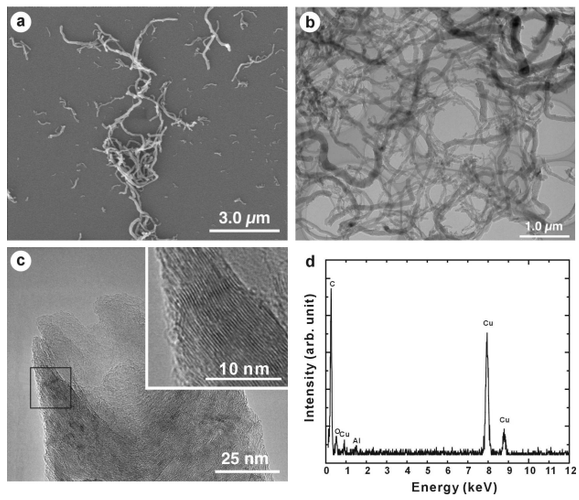

Figure 1. SEM photograph (**a**), TEM photographs (**b** and **c**) of the low and high magnification of the purified hat-stacked-type CNFs. Inset shows the lattice image of the graphene-hat layers. EDX spectrum (**d**) of the purified hat-stacked-type CNFs.

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