

Hierarchical titania coated carbon nanofibrous material derived from natural cellulose substance

Xiao Liu and Jianguo Huang
Zhejiang University, China

Hierarchical titania coated carbon nanofibrous material with high specific surface area ($404 \text{ m}^2 \text{ g}^{-1}$) was fabricated employing natural cellulose substance (filter paper) as scaffold and carbon precursor. Ultrathin titania films were firstly deposited by means of a surface sol-gel process to coat each nanofiber in the filter paper, and successive calcination treatment under nitrogen atmosphere yielded the titania/carbon composite possessing the hierarchical morphologies and structures of the initial paper. The ultrathin titania coating hindered the coalescence effect of the carbon species that formed during the carbonization process of cellulose, and the original cellulose nanofibers were converted into porous carbon nanofibers (diameters from tens to hundreds of nanometers, with 3-6 nm pores) that were coated with uniform anatase titania thin films (thickness ~ 12 nm, composed of anatase nanocrystals with sizes of ~ 4.5 nm). This nanofibrous titania/carbon composite material shows significantly enhanced photocatalytic activity towards photodegradation of organic dyes (methylene blue and rhodamine B) in water under high-pressure fluorescent mercury lamp irradiation or outdoor sunlight. Silver nanoparticles (Ag-NP) with uniform size of ~ 5 nm were introduced into the composite by means of a photocatalytic reduction approach using silver nitrite as precursor, resulting in a Ag-NP/titania/carbon hybrid containing $\sim 9.5\%$ Ag by weight, which showed high antibacterial activity against both gram-positive and gram-negative bacteria due to the synergistic effect of porous carbon nanofibers, ultrathin titania coating and high loading content of silver nanoparticles.

Biography

Xiao Liu was born in Shandong, China. She received BS degree from Shandong Agriculture University in 2004. She is currently on a doctorate course in Zhejiang University under the supervision of Prof. Jianguo Huang. Her research interests include the fabrication of titania nanomaterials used for photocatalysis.

xyliu77@gmail.com