DOI QR Code

Synthesis and characterization of carbon doped TiO_2 photocatalysts supported on stainless steel mesh by sol-gel method

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- Received : 2016.10.06
- Accepted : 2017.02.11
- Published : 2017.04.30

Abstract

This study synthesized pure anatase carbon doped TiO2TiO2 photocatalysts supported on a stainless steel mesh using a sol-gel solution of 8% polyacrylonitrile (PAN)/dimethylformamide (DMF)/TiCl4TiCl4. The influence of the pyrolysis temperature and holding time on the morphological characteristics, particle sizes and surface area of the prepared catalyst was investigated. The prepared catalysts were characterized by several analytical methods: high resolution scanning electron microscopy (HRSEM), energy dispersive spectroscopy (EDS), X-ray diffraction (XRD), Brunauer-Emmett-

Teller (BET), and X-ray photoelectron spectroscopy (XPS). The XRD patterns showed that the supported TiO_2 nanocrystals are typically anatase, polycrystalline and body-centered tetragonal in structure. The EDS and XPS results complemented one another and confirmed the presence of carbon species in or on the TiO_2 layer, and the XPS data suggested the substitution of titanium in TiO_2 by carbon. Instead of using calcination, PAN pyrolysis was used to control the carbon content, and the mesoporosity was tailored by the applied temperature. The supported TiO2 nanocrystals prepared by pyrolysis at 300, 350, and $400^{\circ}C$ for 3 h on a stainless steel mesh were actual supported carbon doped TiO_2 nanocrystals. Thus, $PAN/DMF/TiCl_4$ offers a facile, robust sol-gel related route for preparing supported carbon doped TiO2 nanocomposites.

Keywords

- TiO_2 photocatalyst;, sol-gel method; stainless steel mesh; carbon doping
- https://doi.org/10.5714/CL.2017.22.048 Copy Citation PDF KSCI