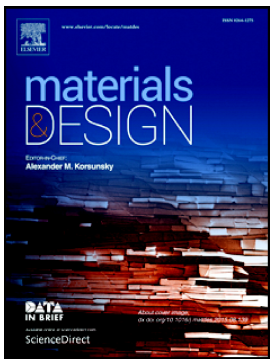

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PII: S0264-1275(18)30217-X
DOI: doi:10.1016/j.matdes.2018.03.038
Reference: JMADE 3780

To appear in: *Materials & Design*

Received date: 19 December 2017
Revised date: 13 March 2018
Accepted date: 14 March 2018

Please cite this article as: Song Chen, Tianlong Wang, Yunhong Yao, Aili Wei , Facile synthesis of novel fibrous silica@apatite@Au composites with superior photo-catalytic activity. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Jmade(2017), doi:10.1016/j.matdes.2018.03.038

Facile synthesis of novel fibrous silica@apatite@Au composites with superior photo-catalytic activity

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Abstract

Novel fibrous silica@apatite@Au composites with superior photo-catalytic activity were facilely synthesized through combination of electrospinning technique, bio-mineralization, and in situ immobilization. Silica nanofibers with the diameter of 486±60 nm were synthesized through electrospinning of the sol-gel mixture of gelatin, tetraethoxysilane, acetic acid, water, and calcium chloride followed by sintering process. After bio-mineralization in the Kokubo's simulated body fluid, silica nanofibers supported in situ deposition of fibrous apatite nanosheet flowers to produce fibrous silica@apatite composites. SEM observations showed that the silica@apatite composites had the fibrous feature with the diameter of 2498±608 nm and their surface was very rough and constructed by numerous apatite nanosheets with the thickness around 10 nm. XRD patterns showed that the fibrous silica@apatite composites presented the characteristic diffraction peaks at 26^o and 32^o assigned to apatite components. FT-IR spectra revealed that silica@apatite composites contained both Si-O-Si bonds and P-O-P groups. After immersion in the suspension of Au nanoparticles, the silica@apatite composites supported the in situ immobilization of Au nanoparticles to produce silica@apatite@Au composites. When incubated in the aqueous mixture of 4-nitrophenol and $NaHB_4$, the fibrous silica@apatite@Au composites presented a superior photo-catalytic activity and rapidly catalyzed the reduction of 4-nitrophenol to 4-aminophenol.

Keywords: Apatite nanosheets; Electrospinning; Silica nanofibers; Bio-mineralization; Au nanoparticles; Photo-catalytic activity