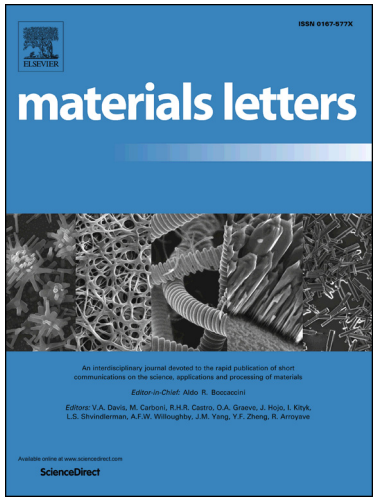

Facile synthesis, microstructure, and photo-catalytic activity of novel flower-like apatite@Au composite nanosheet spheres

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PII: S0167-577X(18)30370-7
DOI: https://doi.org/10.1016/j.matlet.2018.03.014
Reference: MLBLUE 23975

To appear in: *Materials Letters*

Received Date: 23 December 2017
Revised Date: 15 February 2018
Accepted Date: 3 March 2018

Please cite this article as: T. Wang, Y. Yao, A. Wei, L. Jia, S. Chen, Facile synthesis, microstructure, and photo-catalytic activity of novel flower-like apatite@Au composite nanosheet spheres, *Materials Letters* (2018), doi: https://doi.org/10.1016/j.matlet.2018.03.014

Facile synthesis, microstructure, and photo-catalytic activity of novel flower-like apatite@Au composite nanosheet spheres

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Abstract

In this study, novel flower-like apatite@Au composite nanosheet spheres were synthesized through in situ immobilization of Au nanoparticles on the bone-like apatite nanosheets. SEM observations indicated that the as-synthesized spheres had a diameter of 0.8-3 μm and was constructed by numerous primary apatite nanosheets with the thickness around 10 nm. TEM images showed that ～10 nm Au nanoparticles were immobilized on the apatite nanosheets. When incubated with the mixture of 4-nitrophenol and $NaBH_4$, the resultant apatite@Au composite nanosheet spheres exhibited the superior photo-catalytic activity for reduction of 4-nitrophenol.

Keywords: Bioceramics; Nanocomposites; Colloidal processing

1. Introduction

High specific surface area is one of the key parameters of the nano-scaled materials in designation of novel supportive platform of noble metal photo-catalysts [1]. Hydroxyapatite (HAp) nanoparticles (NPs) are the main inorganic component in the hard tissues and have attracted considerable attention in a variety of applications such as drug delivery system [2], bone regeneration [3] and photo-catalyst [4] because of excellent biocompatibility, bioactivity, in-expensiveness and easy availability in large quantity. HAp NPs have been utilized as supportive platforms for immobilization of noble metal photo-catalysts such as Ag [5], Co [6], Cu [7], and Au [8-10]. Such immobilization is advantageous for reducing the agglomeration of noble metal NPs and improving the photo-catalytic activity. However, in most cases, HAp NPs were synthesized via a conventional wet chemical route and presented a needle-like morphology with low specific surface area [5-8].

Since the discovery of graphene [11], nanosheet-based materials have drawn increasing research attention in the fields of electrochemical assay [12], photo-catalyst [13], drug delivery system [14] and tissue regeneration [15] because of their unique sheet-like structure and large specific surface area. Several methods have been employed for synthesis of apatite nanosheets, including hydrothermal synthesis [16] and bio-mimetic route [17]. Compared with other methods, bio-mimetic route has been extensively applied for inducing the deposition of bone-like apatite nanosheets on the bioactive materials such as Bioglass® and silica in the kokubo's simulated body fluid (SBF) because of easy manipulation, low cost, and well-defined microstructure [18]. Our previous studies have demonstrated that the flower-like apatite nanosheets could be successfully