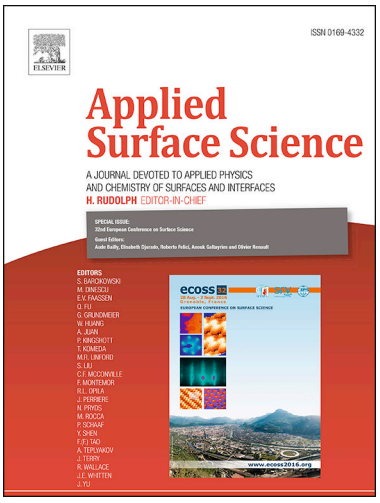
Accepted Manuscript



Full Length Article

One-Step Fabrication of N-doped CNTs Encapsulating M nanoparticles (M=Fe, Co, Ni) for Efficient Microwave Absorption

Mingqiang Ning, Jingbo Li, Boya Kuang, Chengzhi Wang, Dezhi Su, Yongjie Zhao, Haibo Jin, Maosheng Cao

PII: S0169-4332(18)30939-5
DOI: https://doi.org/10.1016/j.apsusc.2018.03.242
Reference: APSUSC 38990

To appear in: *Applied Surface Science*

Received Date: 16 December 2017
Revised Date: 20 March 2018
Accepted Date: 30 March 2018

Please cite this article as: M. Ning, J. Li, B. Kuang, C. Wang, D. Su, Y. Zhao, H. Jin, M. Cao, One-Step Fabrication of N-doped CNTs Encapsulating M nanoparticles (M=Fe, Co, Ni) for Efficient Microwave Absorption, *Applied Surface Science* (2018), doi: https://doi.org/10.1016/j.apsusc.2018.03.242

One-Step Fabrication of N-doped CNTs Encapsulating M nanoparticles (M=Fe, Co, Ni) for Efficient Microwave Absorption

Mingqiang Ning, Jingbo Li*, Boya Kuang, Chengzhi Wang, Dezhi Su, Yongjie Zhao, Haibo Jin*, Maosheng Cao

School of Materials Science and Engineering, Beijing Institute of Technology, Beijing 100081, China.

(*Corresponding author. E-mail: lijb@bit.edu.cn; hbjin@bit.edu.cn)

Abstract

By using a modified non-toxic pyrolysis method, M@NCNTs comprising in-situ formed M nanoparticles encapsulated in nitrogen-doped carbon nanotubes (NCNTs) have been synthesized. Compared to traditional preparation process of M@CNTs (*eg:* acid-aid treatment to CNTs then decorating M particles onto), this method holds the advantage of free of complicated treatment processes. The M@NCNTs exhibit tightly connected interfaces of M/NCNTs and contain abundant N dopants, which could contribute interfacial polarization and defect-dipole polarization to improving the microwave absorption performance. An intense dielectric relaxation is observed in Fe@NCNTs samples, which further enhances the dielectric loss. As expected, the as-synthesized M@NCNTs composites demonstrate promising candidates in microwave absorption (MWA) application. The minimum reflection loss (*RL*) of Fe@NCNTs (with 10 wt% loading) is up to -30.43 dB at 3.2 mm, and the effective absorption bandwidth (*RL*<−10 dB) is as wide as 5.7 GHz which benefits from the neighboring dual absorption peaks induced by the intense dielectric relaxation. Co@NCNTs and Ni@NCNTs also have satisfactory effective absorption bandwidth ~4.08 and ~4.72 GHz, respectively. The modified pyrolysis method is low-cost and non-toxic, which could become an industrial technique to synthesize carbonaceous composites for microwave absorption.

Key words: non-toxic; pyrolysis; heterostructure; Fe/Co/Ni@NCNTs; Electromagnetic matching; microwave absorption

1. Introduction

Since the electromagnetic (EM) pollution is becoming a serious technical and social problem, efforts have being dedicated to explore and design new