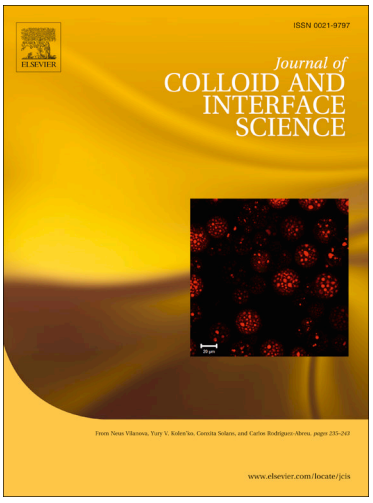

Rational Design of Cobalt and Nitrogen Co-doped Carbon Hollow Frameworks for Efficient Photocatalytic Degradation of Gaseous Toluene

Xinyue Li, Jianan Li, Yong Shi, Mingmei Zhang, Shiying Fan, Zhifan Yin, Meichun Qin, Tingting Lian, Xinyong Li

PII: S0021-9797(18)30590-3
DOI: https://doi.org/10.1016/j.jcis.2018.05.067
Reference: YJCIS 23645

To appear in: *Journal of Colloid and Interface Science*

Received Date: 26 March 2018
Revised Date: 19 May 2018
Accepted Date: 21 May 2018

Please cite this article as: X. Li, J. Li, Y. Shi, M. Zhang, S. Fan, Z. Yin, M. Qin, T. Lian, X. Li, Rational Design of Cobalt and Nitrogen Co-doped Carbon Hollow Frameworks for Efficient Photocatalytic Degradation of Gaseous Toluene, *Journal of Colloid and Interface Science* (2018), doi: https://doi.org/10.1016/j.jcis.2018.05.067

Rational Design of Cobalt and Nitrogen Co-doped Carbon Hollow Frameworks for Efficient Photocatalytic Degradation of Gaseous Toluene

Xinyue Li, Jianan Li, Yong Shi, Mingmei Zhang, Shiying Fan, Zhifan Yin, Meichun Qin, Tingting Lian and Xinyong Li*

Key Laboratory of Industrial Ecology and Environmental Engineering (MOE), School of Environmental Science and Technology, Dalian University of Technology, Dalian 116024, China

Abstract

In this work, the hollow Co/N co-doped carbon frameworks (Co/N-C) were successfully constructed by in situ transformation of zeolitic imidazolate frameworks (ZIF-67) through polycondensation of dopamine. The hollow and porous structure of Co/N-C was demonstrated by transmission electron microscopy (TEM). The doping and Co-N-C active sites were verified by X-ray photoelectron spectroscopy (XPS). The UV-vis diffusion reflectance spectra (UV-vis DRS) of hollow Co/N-C nanoparticles reflected a significant enhancement of optical absorption in the range of 300-800 nm. With hollow porous structure, strong optical absorption and rich Co-N-C active sites, the Co/N-C exhibited a high photocatalytic performance by using gaseous toluene as a model pollutant, and the degradation efficiency of gaseous toluene was found to be around 78.2% under mild conditions (i.e., Temperature = 273 K, Pressue = 1 atom, $\lambda \geq 420$ nm, t = 6 h). The photocatalytic degradation process and mechanism of toluene were further investigated by *in situ* Fourier transform infrared (FTIR) spectroscopy, which indicated that mutiple hydroxylation and benzen ring opening are both involved in the catalytic elmination processes, and the intital intermiate species inluding benzaldehyde and benzoic acid were firstly derived from the hydroxylation due to the hydroxyl radical followed by further oxidation into carbon dioxide and water.

Keywords: Metal-organic frameworks; Volatile organic compounds; Hollow carbon materials; Co/N co-doped; Photocatalyst.

*Corresponding author