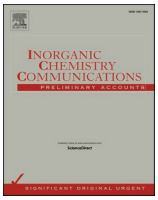
Inorganic Chemistry Communications 142 (2022) 109598

Contents lists available at ScienceDirect

Inorganic Chemistry Communications

journal homepage: www.elsevier.com/locate/inoche



Short communication

Cu doped graphitic C_3N_4 for *p*-nitrophenol reduction and sensing applications

Vattakkoval Nisha [a], Sreejesh Moolayadukkam [b], Anjali Paravannoor [a], Deepthi Panoth [a], Yu-Hsu Chang [c], Shajesh Palantavida [d], Steven J. Hinder [e], Suresh C. Pillai [f,g], Baiju Kizhakkekilikoodayil Vijayan [a,*]

[a] *Department of Chemistry/Nanoscience, Kannur University, Swami AnandaTheertha Campus, Payyannur, Edat P.O., Kerala 670307, India*
[b] *Energy Materials Lab, Centre for Nano and Soft Matter Sciences (CeNS), Bangalore, 562 162 Karnataka, India*
[c] *Department of Materials and Mineral Resources Engineering, Institute of Mineral Resources Engineering, National Taipei University of Technology, Taipei 10608, Taiwan*
[d] *Centre for Nano and Materials Science, Jain University, Jakkasandra, Ramanagaram, Karnataka, India*
[e] *The Surface Analysis Laboratory, Faculty of Engineering and Physical Sciences, University of Surrey, Guildford, Surrey, UK*
[f] *Nanotechnology and Bio-Engineering Research Group, Department of Environmental Science, Faculty of Science, Atlantic Technological University, ATU Sligo, Ash Lane, Sligo F91 YW50, Ireland*
[g] *Health and Biomedical (HEAL) Strategic Research Centre, Atlantic Technological University, ATU Sligo, Ash Lane, Sligo F91 YW50, Ireland*

ARTICLE INFO

Keywords:
Copper doped carbon nitride
P-Nitrophenol reduction
Paracetamol sensor

ABSTRACT

A series of Cu doped graphitic carbon nitride (*g*-C_3N_4) catalysts with different ratios of copper were synthesized by thermal method, using urea and copper sulphate as precursors. XPS (X-ray Photoelectron Spectroscopy) studies indicated that the peak of N1s at 398.9 eV is due to Cu—N bond and a peak at 932.9 eV showed the presence of Cu—N—C bond. Catalytic hydrogenation of *p*-nitrophenol (Para-NP) to *para*-aminophenol (Para-AP) in presence of *g*-C_3N_4 (gCN) and copper doped *g*-C_3N_4 (CN-Cu) with sodium borohydride ($NaBH_4$) was investigated by UV–Visible spectroscopy. The as-synthesized graphitic carbon nitride with 1% copper (CN-1Cu) doped sample exhibits superior catalytic performance and higher stability compared to fine Cu powder in the second cycle. Additionally, electrochemical paracetamol sensing properties of the samples were studied using cyclic voltammetry and chronoamperometry. Consistent with the catalytic performances, CN-1Cu exhibited greater sensitivity towards the detection of paracetamol within the broad range of 38 μM to 3.64 mM and the study was carried out in the physiological pH ~ 7.4.

1. Introduction

In recent years, graphitic carbon nitride (*g*-C_3N_4) nanosheets, a special class of 2D materials with layered organic frameworks of carbon and nitrogen have received growing and remarkable attention due to their exceptional physicochemical and thermodynamic properties [1]. Carbon nitride is a non-toxic, metal-free and inexpensive semiconductor material, identical to graphene in its two-dimensional layered morphology with carbon to nitrogen in the ratio (C:N) of 3:4 [2,3]. In comparison to other semiconductors such as ZnO and TiO_2, *g*-C_3N_4 can be easily synthesized using a variety of methods and has desirable electrical structure and morphology, as well as high thermal stability up to 600 °C.[4] It has gained significant importance in several emerging applications such as sensors, water splitting, fuel cells, energy storage devices, and transparent conductors due to their unique properties such as greater charge carrier mobility and high mechanical-thermal-chemical stability [3–8].

Owing to their fascinating properties, g-C_3N_4 has been widely being investigated for their catalytic properies by several groups. In one of the recent studies, Gholpour et al. described that mesoporous g-C_3N_4 catalysts can be used for the conversion of alcohols in presence of CO_2 and O_2 or N_2 [9]. Sarkar et al. reported that Cu doped *g*-C_3N_4 shows excellent electrocatalytic performance towards oxygen reduction reaction in the basic medium [10]. Mohammadi et al. developed copper oxide nanorods decorated with *g*-C_3N_4 nanosheets for the synthesis of primary amide in water [11]. Covalently bonded sulfamic acid graphitic carbon nitride

* Corresponding author.
E-mail address: baijuvijayan@kannuruniv.ac.in (B.K. Vijayan).

https://doi.org/10.1016/j.inoche.2022.109598
Received 5 February 2022; Received in revised form 21 May 2022; Accepted 25 May 2022
Available online 28 May 2022