ChemistrySelect / Volume 6, Issue 24 / p. 6050-6055

Full Paper

Enhanced Electrochemical NO_2^-Oxidation Reactions on Biomolecule Functionalised Graphene Oxide

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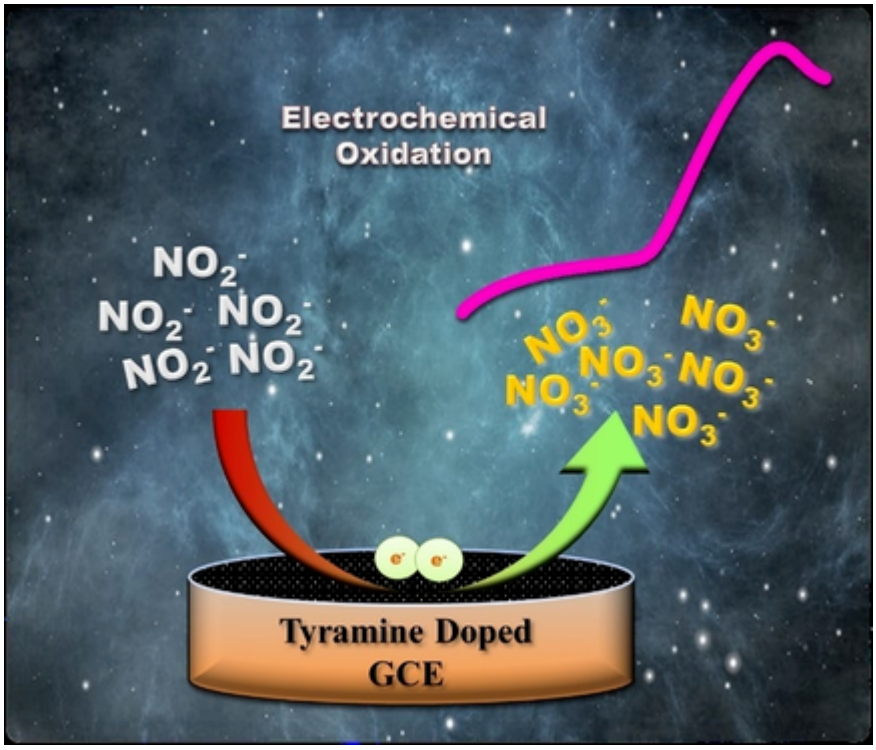
First published: 29 June 2021
https://doi.org/10.1002/slct.202100608
Citations: 3

Graphical Abstract

Electrochemical oxidation of nitrite (NO_2^-) using metal-free, electrochemically highly stable, and selective biomolecule i. e. tyramine functionalized graphene oxide (GT) electrocatalyst for nitrite oxidation in phosphate buffer at pH-7.



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Herein, electrochemical oxidation of nitrite (NO_2^-) is demonstrated using metal-free, electrochemically highly stable, and selective biomolecule i. e. tyramine functionalized graphene oxide (GT) electrocatalyst for nitrite oxidation in phosphate buffer at pH-7. The successful functionalization of a biomolecule on graphene is carried out by a simple chemical method. The surface features of biomolecule functionalized graphene oxide were studied by using both spectroscopic and microscopic techniques including scanning electron microscope (SEM) which shows wrinkled and folded structures having a thickness of ~20 nm corresponding to a few layer of graphene. Moreover, their structural analysis was carried out using X-ray photoelectron spectroscopy nitrogen band at peak position of ~400 eV reveals biomolecule functionalization, Fourier-transform infrared spectroscopy (FTIR) reveals significant peak at 1580 cm^{-1} corresponding to amine functionalization, Raman Spectroscopy reveals enhanced I_D/I_G ratio as compared to GO. The electrochemical surface area (ECSA) found tobe 3.60 cm^2. The as-synthesized electrocatalyst is found to be more active towards electro-oxidation of nitrite (NO_2^-) at a low onset potential of 0.6 V vs saturated calomel electrode (SCE) from linear sweep voltammetry (LSV), cyclic voltammetry (CV), and electrochemical impedance spectroscopy (EIS) measurements. Moreover, its current stability at a given potential is also tested by chronoamperometric (i-t) measurements within a concentration range of 0 μM to 7 μM and is having long term good electrochemical stability at an onset potential of 0.6 V vs SCE. The onset potential of GT was 0.6 V vs SCE, the limit of detection (LOD) 0.933 μM and high current density 21 mA cm^{-2} as compared to GO 8.7 mA cm^{-2}. Considering above perspectives, our findings emphasizes the importance of biomolecule functionalised GO is the best electrocatalyst for electro-oxidation of nitrites, which is one of the important species for environmental remediation.

Conflict of interest

The authors declare no conflict of interest.

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