

L06-2667 - (*Invited*) Enhancing Oxygen Reduction Reaction on Graphene Materials Produced via Electrochemical Exfoliation



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1520 - 1540



Room 512G (5th Floor, The Palais des congrès de Montréal)

Abstract

Electrochemical exfoliation of graphite in aqueous solutions is a simple and robust method for producing large quantities of graphene-based materials within a few hours [1]. This process involves the attack of edges and grain boundaries of graphite by oxidizing species (OH^- , OH^\bullet , O^\bullet) formed in the electrolyte due to the application of a potential bias between the graphite electrode and the counter electrode. This is followed by the intercalation of ions and water molecules between the graphite layers, leading to layer expansion, gas evolution, and ultimately, the exfoliation of the graphene oxide sheets [2]. Typically, the resulting materials consist of large flakes (tens to hundreds of microns) with a low density of structural defects, including oxygenated functional groups (C/O ratio > 4) [3]. Despite their high electrical conductivity (in the order of tens Scm^{-1}), their electrocatalytic activity for the oxygen reduction reaction (ORR) is hindered by their inherent flake sizes and surface chemistry.

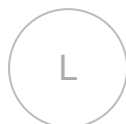
In this communication, we present and discuss our recent efforts to enhance the activity and selectivity of this class of graphene-based materials for ORR. By carefully selecting exfoliation conditions (applied voltage, electrolyte composition, exfoliation time, cell geometry), we can reduce the flake size, increase the density of oxygenated functional groups, and improve the ORR activity. Case studies include the one-step synthesis and simultaneous functionalization of graphene materials with organic moieties [4], as well as the impact of the electrochemical cell geometry.

References

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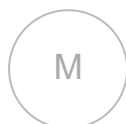
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Authors



Yuting Lei

INRS - Centre Énergie Matériaux Télécommunications



Ludmila Madalena

INRS - Centre Énergie Matériaux Télécommunications



Isabela Fiori de Araujo

Instituto de Quimica de Sao Carlos, Universidade de Sao Paulo



Fausto Bimbi Junior

Instituto de Quimica de Sao Carlos, Universidade de Sao Paulo



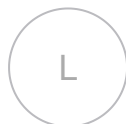
Safa Chaaben

INRS - Centre Énergie Matériaux Télécommunications



Benjamin D. Ossoinon

Institut National de la Recherche Scientifique



Marcos R.V. Lanza

University of Sao Paulo

Corresponding Author



Ana C. Tavares

Institut National de la Recherche Scientifique – Centre EMT

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