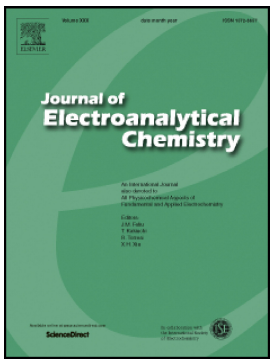


# Nanoparticles based on copper deposited on carbon spheres. Preparation, characterization and application for CO2 photo-electrochemical reduction

S. Benammar, A. Boudjemaa, G. Nezzal, S. Gómez-Ruiz, D. Meziane, K. Bachari, A. Lounis, Neil J. Coville

PII: S1572-6657(17)30882-2
DOI: https://doi.org/10.1016/j.jelechem.2017.12.007
Reference: JEAC 3712

To appear in: *Journal of Electroanalytical Chemistry*

Received date: 24 April 2017
Revised date: 4 December 2017
Accepted date: 5 December 2017

Please cite this article as: S. Benammar, A. Boudjemaa, G. Nezzal, S. Gómez-Ruiz, D. Meziane, K. Bachari, A. Lounis, Neil J. Coville , Nanoparticles based on copper deposited on carbon spheres. Preparation, characterization and application for CO2 photo-electrochemical reduction. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Jeac(2017), https://doi.org/10.1016/j.jelechem.2017.12.007

# Nanoparticles based on copper deposited on carbonspheres. Preparation, characterization and application for $CO_2$ photo-electrochemical reduction

S. Benammar[1,2], A. Boudjemaa[2], G. Nezzal[1], S. Gómez-Ruiz[3], D. Meziane[1], K. Bachari[2], A. Lounis[4], Neil J. Coville[5]

[1]*Laboratory of Industrial Processes Engineering Sciences, LSGPI, Faculty of Mechanical and Engineering Processes, (USTHB), BP 32, 16111 Algiers, Algeria*

[2]*Centre de Recherche Scientifique et Technique en Analyses Physico-Chimiques, BP 384, Siège ex-Pasna Zone Industrielle, Bou-Ismail CP 42004, Tipaza, Algérie*

[3]*Departamento de Biología y Geología, Física y QuímicaInorgánica, ESCET Universidad Rey Juan Carlos Móstoles Spain*

[4]*Faculty of Mechanical and Engineering Processes, (USTHB), BP 32, 16111 Algiers, Algeria*

[5]*DST-NRFCentre of Excellence in Strong Material sand the Molecular Sciences Institute, School of Chemistry, University of the Witwatersrand, Johannesburg 2050, South Africa*

## Abstract

In this study, we have examined the performance of copper nanoparticles deposited on carbon spheres with a mass weigh of 10 wt.% (labeled 10Cu-CSs) via photo-electrochemical reduction of carbon dioxide ($CO_2$). The carbon spheres (CSs) were prepared by a chemical vapor deposition method and 10Cu-CSs was made via a homogeneous deposition precipitation method. The materials were characterized by different physico-chemical techniques such as X-ray diffraction (XRD), Raman, Fourier transform infrared (FTIR) and diffuse reflectance (DR) spectroscopy, electrical conductivity and photo-electrochemical studies. The 10Cu-CSs material was studied for the photo-electrochemical reduction of $CO_2$ under visible light illumination. The synthesized material exhibited a single phase monoclinic structure of CuO deposited on CSs as confirmed by XRD, Raman and FTIR spectroscopies results. The semi-conductor property was established by electrical conductivity, and the activation energy obtained was *ca.* 0.04 eV. The UV-visible absorption spectrum showed a direct band gap transition with gap energy of 1.22 eV. The material synthesized was a cathode