Green synthesis of iron oxide hematite Fe_2O_3 and its performance in energy storage applications

A. Zine[1], N. Kebaili[3], S. Achour[2] and D. Hamana[2]
[1] *Science of materials and applications unit URSMA Brothers Mentouri University, 325 Ain El Bey Road, Constantine Algeria*
[2] *National Polytechnic School of Constantine, PB 75A RP Ali Mendjeli, Constantine Algeria*
[3] *Aime Cotton Laboratory, UMR 9188, CNRS, Université Paris Sud, ENS Paris Saclay France*
zine.abderaouf@umc.edu.dz

The foreseen depletion of conventional energy resources coupled to the greenhouse gases emissions is urging the scientific community to find energy alternatives. Active materials based on nanostructured and/or mesoscopic metal oxides are possible promising candidates, as catalyst supports or photocatalysts, photoelectrochemical properties or energy storage abilities.

A green synthesis method for the preparation of mesoporous hematite α-Fe_2O_3 nanoparticles has been developed using olive leaves extract (OLE) via bottom up reflux system. This simple method can suitably be scaled up for large-scale synthesis and provide. The as-prepared mesoporous nanoparticles were characterized by XRD, RAMAN, BET, FESEM, XPS, UV–visible spectroscopy and TEM. The nanoparticles appeared highly pure and well crystallized and can be considered as very promising for the decomposition of water into oxygen and hydrogen by photoelectrochemical (PEC) studies.

$$2H_2O_{(l)} + hv \rightarrow O_{2(g)} + 4H^+ + 4e^- \quad , \qquad 2H^+ + 2e^- \rightarrow H_{2(g)}$$

Furthermore, low cost SC material synthesised by green route also is a considerable interest to focus on. Accordingly, the product obtained was used as an active electrode to fabricate symmetric supercapacitors, it shows a good improvement in specific capacitance C_{sp}. Energy storage strongly depends on morphology, specific surface area, porosity of the mesoporous hematite.

Keywords: Olive leaves extract (OLE), mesoporous α-Fe_2O_3, photoelectrochemical (PEC), specific capacitance C_{sp}.