Functional Oxide Nanoparticles for Hydrogen Generation

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ABSTRACT

Nanomaterials are among the most challenging areas of current scientific and technological research because of the variety of interesting changes in their properties at nano-dimension. Now a days, functional nanomaterials find the possibility for their applications in water splitting processes for hydrogen generation as a renewable source of green energy. Iron oxide nanocubes were prepared in one pot process for the electrochemical water splitting and supercapacitor applications. Magnetic measurements indicate that the as-synthesized nanocubes are ferromagnetic at room temperature. The synthesized nanocubes have high specific surface area of 000 m^2g^{-1}, which affects the electro-catalytic activity of the electrode materials. The electro-catalytic performances of the IONPs for the HER and supercapacitors were investigated in alkaline medium (0.0 M KOH) versus Ag/AgCl at room temperature. Similarly, ultrafine ruthenium oxide nanoparticles have been prepared through a wet chemical method at 000 °C. The catalytic activity of ultrafine RuO_2 was examined against the Horseradish peroxidase enzyme at high temperature and the nanoparticles were applied as sensor for the detection of H_2O_2 in the solution. Besides that, the stimulating bifunctional electro-catalytic performance of RuO_2 nanoparticles was studied under different atmospheric conditions viz, air, N_2 and O_2 for oxygen evolution reaction and oxygen reduction reaction respectively versus reversible hydrogen electrode in alkaline medium. Yttrium Ferrite of nearly spherical nanoparticles were prepared by citrate precursor method at reasonably low temperature with high specific surface area of 000 m^2/g and visible band gap of 0.0 eV. Photocatalytic generation of hydrogen by using these nanoparticles has also been studied under the visible light irradiations which showed a significant H_2 evolution.

Keywords: Functional Nanoparticles; Metal Oxides; Hydrogen Generation; Chemical Synthesis; Multiferroics.

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Reference:

1. T. Ahmad, I. H. Lone and M. Ubaidullah, RSC Advances, 5, 58065–58071, 2015.
2. T. Ahmad and I. H. Lone, New Journal of Chemistry, 40, 3216-3224, 2016.
3. T. Ahmad, I. H. Lone, S. G. Ansari, J. Ahmed, T. Ahamad and S. M. Alshehri, Mater. Des. 126, 331-338, 2017.
4. T. Ahmad, R. Phul, N. Khatoon and M. Sardar, New J. Chem. 41, 2055-2061, 2017.
5. T. Ahmad, U. Farooq and R. Phul, Industrial & Engineering Chemistry Research, 57 (1), 18-41, 2018.
6. S. M Alshehri, J. Ahmed, A. N Alhabarah, T. Ahamad and T. Ahmad, ChemElectroChem, 4, 2952–2958, 2017.
7. U. Farooq, R. Phul, S. M. Alshehri, J. Ahmed and T. Ahmad, Scientific Reports (Nature), 9, 4488 (1-17), 2019.

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