J Material Sci Eng 2018, Volume 7
DOI: 10.4172/2169-0022-C2-095

Photon upconversion, morphology dependent magnetic property, a high sensitive non-enzymatic hydrogen peroxide and hydrazine electrochemical sensing study of 3D micro-snowflake structured α-Fe_2O_3

S. Majumder [1], **B. Saha**[2], **S. Kumar**[3] and **S. Banerjee**[4]
[1,3]Jadavpur University, India
[2,4]Saha Institute of Nuclear Physics, India

In this manuscript we have successfully synthesized a large scale 3D dendritic α-Fe_2O_3 hierarchical structure *via* a hydrothermal reaction1. The crystallinity, composition, purity, morphology of the synthesized α-Fe_2O_3 is characterized by PXRD, FESEM, TEM, EDS, FTIR and Mossbauer analysis. The FESEM and TEM images reveal that the sample exhibit micro-snowflake like shape having six-fold symmetry with symmetric branching along each arm consists of a long central trunk and secondary branches. Various shape and morphology of α-Fe_2O_3 have been modeled on the basis of their growth evolution. The UV-Vis spectra shows visible light absorption and PL exhibiting a peak near UV region indicates up-conversion property. So, we can use this sample for visible light mediated catalysis applications, photodectector and photo-voltaic application purposes. Here the effect of morphology of α-Fe_2O_3 on their magnetic property has been studied by M-T (100 Oe applied field) and M-H (at 10K, 100K, 300K). The variation in surface adsorbed OH- ions causes surface spin pinning, and as a result, the spin relaxation mechanism is disturbed, results to higher coercivity. The spin pinning and the associated magnetic surface anisotropy are the possible reason for increase in coercivity. At low temperature Exchange bias has been observed. Cyclic voltammetry (CV) study indicates that this α-Fe_2O_3 structure shows excellent performance towards hydrogen peroxide (H_2O_2) reduction and hydrazine (N_2H_4) oxidation in alkaline medium. Further, amperomatric I-t measurements show a high sensitivity of 7.16 μA/mM/cm2 in a wide range of 0.1-5.5 mM with the limit of detection of 0.01 mM (S/N=3) towards H_2O_2 sensing. The sample also exhibits a good sensitivity of 24.03 μA/mM/cm2 in the linear range between 50 μM and 1340 μM with the limit of detection of 5 μM towards hydrazine detection1. Good reproducibility, stability and selectivity suggest its suitability for fabrication of H_2O_2 and hydrazine sensor.

sumitmajumder2779@gmail.com