J Phys Chem Biophys 2018, Volume 8
DOI: 10.4172/2161-0398-C1-029

5th International Conference on

Theoretical and Applied Physics

July 02-03, 2018 | Vienna, Austria

Hematite to magnetite phase transition in microwave assisted sol-gel synthesis of iron oxide thin films—role of aluminum doping

Sidra Khalid[1,2], **Saira Riaz**[2] and **Sehzad Naseem**[2]
[1]University of Management and Technology, Pakistan
[2]Punjab University, Pakistan

Doped iron oxide thin films have attracted widespread interest in recent years by virtue of their unusual magnetic and electronic applications in magnetic random access memories, spin transistors and data storage devices. Three important crystallographic phases of iron oxide include magnetite (Fe_3O_4), maghemite (γ-Fe_2O_3) and hematite (α-Fe_2O_3). Among these phases of iron oxide, magnetite and maghemite are of particular importance due to their magnetic moment. Magnetic and electronic properties of iron oxide thin films can be enhanced/tuned using doping strategies. Aluminum doped iron oxide thin films were prepared using microwave assisted sol-gel method with fixed microwave power of 720W and dopant concentration of 0%, 2%, 4%, 6%, 8% and 10%. For structural and phase analysis, Bruker D8 Advance X-ray diffractometer was used. Magnetic analysis was carried out using Lakeshore's 7407 vibrating sample magnetometer. Impedance and dielectric analysis was done using 6500B Precision Impedance Analyzer. XRD results confirm formation of maghemite phase in undoped iron oxide thin films. With increase in dopant concentration from 0% to 4%, maghemite phase of iron oxide persists. However, intensity of diffraction peaks decreases. Decrease in intensity of diffraction peak indicates that dopant atoms occupy the vacancies on the cationic sublattice. As dopant atoms occupy the vacancies in the cationic sublattice, transition from maghemite to magnetite phase was observed at high dopant concentration of 6%. With further increase in dopant concentration to 8% intensity of diffraction peaks increases indicating strengthening and increased crystallinity of the films. Higher dopant concentration of 10% resulted decrease in crystallite of the films. However, magnetite phase persisted at high dopant concentration. Variation in dopant concentration resulted in changes in structural parameters. Saturation magnetization increase from 248.403 emu/cm^3 to 288.24007 emu/cm^3 was observed with an increase in dopant concentration from 0% to 4%. Further increase in dopant concentration resulted in increase in magnetization to 404.82 emu/cm^3 arises due to phase transition from maghemite to magnetite. High dielectric constant of magnetite thin films 135.47 (log f=5.0; dopant concentration 8%) arises due to formation of magnetite phase. Changes in dopant concentration and phases results in changes in grain boundary resistance and relaxation time, thus affecting the dielectric properties.

sidra.khalid@umt.edu.pk