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Magnesium Ferrite Nanoparticles For Photo Catalyst And Humidity Sensor

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Magnesium ferrite ($MgFe_2O_4$) nano-particles were successfully fabricated by the wet chemical process. X-ray diffraction (XRD), FT-IR, and transmission electron microscopy (TEM) revealed the formation of $MgFe_2O_4$ nano-particles at room temperature. UV-Visible spectroscopy is performed and the band gap is found to be 2.22eV. XRD and TEM result shows that the particles are very small and spherical in shape with diameter in the range of 4.5-10 nm. Room temperature variable sample magnetometer (VSM) spectroscopy showed a ferromagnetic behavior (tending to super-paramagnetic) of room temperature synthesized $MgFe_2O_4$ nano-particles, having the specific saturation magnetization (M_s) value of about 7 emu/g, remnant magnetization (M_r) value of 0.013 emu/g. The small ratio of remnant magnetization to bulk saturation magnetization, M_r / M_s of the $MgFe_2O_4$ nano-particles was obtained as 0. 0018 indicating appreciable fraction of super-paramagnetic particles. The coercive force (H_c) was obtained to be 24.11Oe.

The humidity sensing property of the material is studied by plotting the variation of impedance of the material at varying frequency at different temperature and humidity. The synthesized nano-particles of the complex compound $MgFe_2O_4$ are highly porous as compared to the nano-particles of the other simple compounds like ZnO, SnO_2, TiO_2 and CdS. Due to its high porosity, magnesium ferrite ($MgFe_2O_4$) nano-particles have great advantage over the other simple compounds in sensing the relative humidity.

The synthesized $MgFe_2O_4$ nano-particles are used as the photo-catalyst for the waste water treatment by degrading the Methylene blue (MB) dye ($C_{16}H_{18}ClN_3S$). 53.7411 % degradation of Methylene blue is achieved in 2 h. Magnetic measurements revealed that the photo-catalyst material can be separated from the water when an external field was added and was re-dispersed into the water after the external magnetic field is eliminated.