Proc. of the Intl. Conf. on Nanotechnology for Better Living, 2016
Editors K. K. Kar, A. Shah and R. Sharma
Vol. 3, No. 1, p. 170
doi:10.3850/978-981-09-7519-7nbl16-rps-170

Magnetic and dielectric properties of V-doped TiO_2 nano-particles

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TiO_2 is a well-known wide band gap semiconducting material used as photocatalyst, UV-absorber and pigment. It plays important role in novel applications like solar cells, fuel cells, different sensors, UV protector, UV stabilizers, waste management, pollution control system and self-cleaning glass coating materials along with cosmetic, paint, varnishes, Dielectric mirror etc. [1,2]. As pure TiO_2 has band gap 3-3.2 eV [3], its applications are limited in VU light region. Vanadium doping is one of the most popular ways to tune its bandgap to make it applicable in visible light also. Though there are large numbers of works on TiO_2 are already reported but its magnetic and dielectric properties are not much explored. In this report we are presenting the study on magnetic and dielectric properties of V-doped TiO_2. $Ti_{(1-x)}V_xO_2$ nanoparticles were prepared by modified pechini method for x= 0, 0.01, 0.03, 0.06 and 0.09. Figure 1 shows the XRD patterns of the prepared $Ti_{(1-x)}V_xO_2$ ($0 \le x \le 0.09$) nanoparticles.

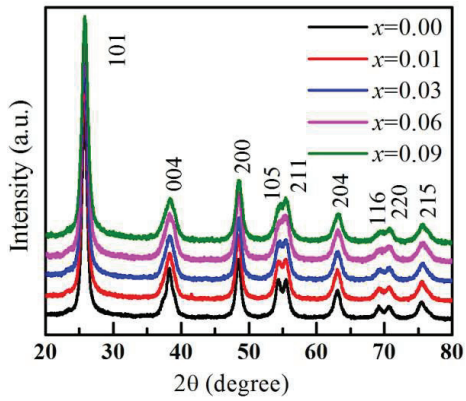

Figure 1: Pure anatse phase in XRD of $Ti_{(1-x)}V_xO_2$ ($0 \le x \le 0.09$) nanoparticles

The study on temperature dependence of magnetic property of pure as well as V-doped TiO_2 was carried out for temperature range 5 K to 300 K with 5000 Oe magnetic field (Figure 2). Magnetic moment remains almost constant between 200 and 300 K. Below 200 K, moment increases as temperature decreases and start increasing sharply below 50 K with further decrease in temperature. As the amount of V-substitution increases, this behavior becomes more prominent.

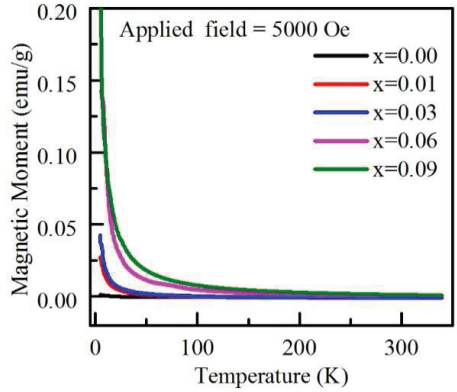

Figure 2: Temperature dependence of magnetic moment of $Ti_{(1-x)}V_xO_2$ ($0 \le x \le 0.09$) nanoparticles

In order to study dielectric properties we have done dielectric measurement for broad temperature range from 200 K to 600 K and frequency ranging from 100 Hz to 10 MHz.

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