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Synthesis and characterization of SnO_2 nanoparticles by gel combustion method

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Solid-state gas sensors are widely used in semiconductor processing, medical diagnosis, environmental sensing, personal safety and national security. The materials that change their properties depending on the ambient gases can be utilized as gas sensing materials. Many transition metal oxides such as Cr_2O_3, Mn_2O_3, Co_3O_4, NiO, CuO, CdO, MgO, WO_3, TiO_2, V_2O_5, Fe_2O, GeO_2, Nb_2O_5, MoO_3, Ta_2O_5, CeO_2, ZnO and SnO_2 exhibit sensitivity towards oxidizing and reducing gases by varying their electrical properties. However, among the above oxides nanostructured Tin dioxide-based gas sensor devices are very important in developing n-type semiconductor sensors. Tin Oxide (SnO_2) nanopowder was prepared by gel combustion method. Metallic tin pellets, nitric acid, citric acid and ammonium hydroxide were used for the synthesis of SnO_2nanopowder.The whole process was carried out at 600 °C. The citric acid as a fuel plays an important role in the formation of the nanostructured SnO_2. The powdered sample was characterized by X-ray powder diffraction (XRD), Scanning Electron Microscope (SEM) and UV-visible spectroscopy (UVS).

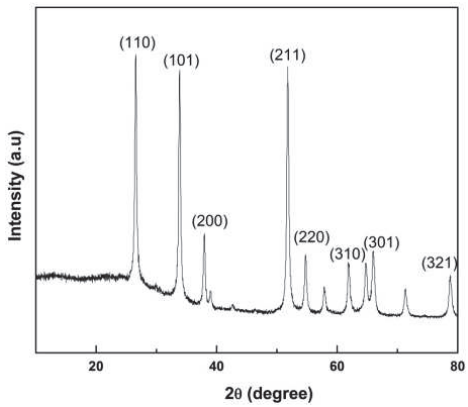

Figure 1: XRD pattern of prepared SnO_2 powder

Figure 1 shows the X-ray diffraction (XRD) pattern of the as-prepared sample is indexed to the tetragonal structure of $SnO_2$and the crystallite size of the powders was in the nanometric range and average crystallite size calculated as ~21 nm from the XRD line broadening, which is further confirmed by Transmission Electron Microscopy (TEM). Which shows particle size in the range of 17-25 nm. Scanning electron microscope (SEM) of synthesized SnO_2 powder shows clustering of particles have occurred on the surface with a loosely bound network and the closer view of an individual structure confirms the spherical shape particles agglomerated uniformly in thin platelets. Energy dispersive spectra (EDS) of the same confirm the presence of Sn and O.

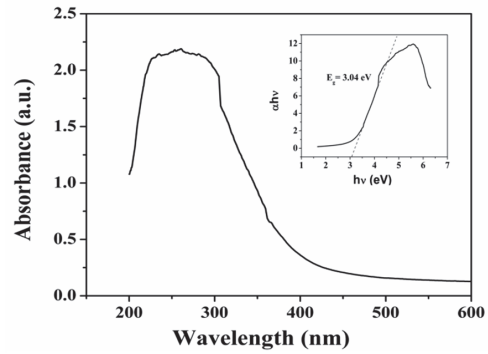

Figure 2: UV spectra of prepared SnO_2 powder

Analysis of the UV-visible spectrum as shown in Figure 2 showed the band gap of the synthesized SnO_2 is approximately 3eV, which is also matched with previously reported literatures.

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