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STRUCTURAL AND RAMAN SPECTROSCOPIC CHARACTERIZATION OF C-TIO2 NANOTUBES SYNTHESIZED BY TEMPLATE-ASSISTED SOL-GEL TECHNIQUE.

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Un-doped and carbon-doped titanium dioxide nanotubes (C-TNTs) were synthesized using a template-assisted sol-gel technique employing titanium tetra butoxide precursor and oxalic acid as the dopant. SEM, XRD, FTIR and Confocal Raman spectroscopy (CRS) was used to evaluate the morphological and structural properties of the as-synthesized TNTs. SEM analysis has revealed the presence of closely-packed TNTs, with a modal external tube diameter of 150, 170, 210,190 and 210 nm for the un-doped TNTs, 9mM C-TNTs, 27 mM C-TNTs, 45 mM C-TNTs and 75 mM C-TNTs respectively. SEM analysis has also shown that the TNTs become loosely-packed with increasing dopant concentration. SEM-EDX spectra have revealed the presence of Ti peaks at 0.45 and 4.9 KeV corresponding to Kα1 and Kβ1 emission line respectively. Oxygen exhibits a signal at 0.5 keV corresponding to Kα1 emission line. The occurrence of these peaks in the EDX spectra endorses the existence of Ti and O atoms in the prepared titanium dioxide nanotubes. FTIR spectroscopy has revealed the presence of vibrational modes at 580-660 cm-1 indicating the presence of Ti-O bonds and additional vibration modes at 2324 cm-1 resulting from C-O stretching in the carbon doped samples XRD analysis has revealed the presence of a mixed Anatase-Brookite phase with diffraction peaks 2θ angles of 25.49^0, 38.11^0, 40.60^o 48.14 ^{0}, 54.58^0, 63.00^0, 70.11^0 and 75.66^0. Additionally, XRD analysis has revealed elongation of lattice parameter “c” from 9.143 to 9.830 Å with increase carbon concentration. Lattice expansion indicates the possibility of carbon substituting oxygen sites. CRS large area scan in the XY direction has revealed the presence of Raman active modes at 153.19 cm-1, 205.62 cm-1,328.33 cm-1, 404.55 cm-1, 523.26 cm-1, 523.26 cm-1 and 648.69 cm-1 belonging to a mixed Anatase-Brookite phase. CRS depth profiling in the XZ direction has also validated the presence of a mixed Anatase-Brookite phase with Raman active modes 153.19, 208.87, 404.55, 523.26 and 648.55 cm-1.

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