Physical and electrochemical characterization of laser processed anodic semitransparent titania oxide nanotubes formed out of Ti-Au co-sputtered alloy

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Aligned semitransparent oxide nanotube material has been synthesized by anodizing titanium–gold alloy co-sputtered atop indium–tin oxide coated glass substrate. After calcination, the samples were subjected to laser processing (355 nm wavelength, 2 Hz repletion rate, and 6 ns pulse duration) with varying fluence ranging from 20 to 100 mJ/cm^2. Well-defined continuous tubular architecture was observed under the SEM for the untreated sample. However, the laser processed samples show the formation of gold nanoparticles and partial melting as well as agglomeration of the top surface; i.e. for the sample treated with 20 mJ/cm^2 laser fluence, the gold nanoparticles were formed at the crown position of the nanotubes. The energy band-gap reduction was observed in comparison to bare titania reference material and the presence of gold nanoparticles resulted in appearance of characteristic fringes on the UV-VIS spectra that can be attributed to surface plasmon resonance effect, photonic behaviour or constructive and destructive interference of reflected light [1]. Moreover, the electrochemical measurements carried out in appropriate electrolyte with and without the redox species showed pseudo-metallic behaviour exhibiting very low impedance for the prepared oxide materials that can be utilized in sensing applications.

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