Influence of mono energetic gamma radiation on structural and electrical properties of TiO_2 thin film coated on p-type porous silicon

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Abstract

Titanium dioxide thin film was coated on p-type porous silicon by sol–gel spin coating method. The prepared samples were irradiated by the mono-energetic gamma radiation at Auto-irradiation facility with the Cesium-137 for the Gamma dose range from 100 to 1000 mSv. Gamma irradiated samples revealed that the physical changes of titanium oxide/porous silicon layer found to be varying with increasing gamma dose. The irradiated titanium oxide/porous silicon layer were investigated by scanning electron microscopy, X-ray diffraction, Fourier transform infra-red, Photoluminescence and I–V characteristics studies. The surface morphology of the irradiated titanium oxide/porous silicon layer has shown deformation with increasing gamma dose. The X-ray diffraction patterns of titanium oxide/porous silicon layer after irradiation revealed changes in crystallite size, dislocation density, strain and phase content. These changes in anatase (004) are linear with gamma dose than the rutile (310) of TiO_2-PSi. Fourier transform infra-red spectrums of the irradiated samples showed an increase in intensity of vibration modes with the increase of the radiation dose. Photoluminescence peaks are found to be in the range of 330 to 360 nm for all the irradiated samples and the intensity of Photoluminescence peak increased for the irradiated samples with increasing gamma dose. I–V Characteristics revealed that the electrical conductivity of irradiated samples increased linearly with gamma dose. The linear changes in electrical property of titanium oxide/porous silicon under the influence of mono-energetic gamma photons gives a positive indication that it can be further studied for the development of radiation sensor for applications in nuclear field.