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Non-linear structural and surface morphological modifications due to gamma irradiation in p-type porous silicon(Article)

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Abstract

The effect of gamma irradiation on the morphology and electrical properties of p-type porous silicon prepared by electro-chemical etching is investigated after total irradiation dose of 0.5Gy, 2Gy, 5Gy and 10Gy by gamma radiation from the ^{137}Cs radiation source. Structural changes are studied with the support of X-Ray Diffraction, Scanning Electron Microscope, Fourier Transform Infra-Red spectroscopy, Atomic Force Microscope and the electrical property changes are investigated by I–V characterization. X-Ray Diffraction peak at Si(400) showed peak broadening with increasing gamma dose. The size of crystallite in the PSi samples as prepared is 119.54 nm and it is reduced to 14.79 nm for the PSi sample irradiated with the gamma dose of 10 Gy. The irradiated PSi samples show a non-linear reduction in crystallite size and exhibit radiation hardness for the total gamma irradiation dose ≤ 5Gy. Scanning Electron Microscope images of the irradiated PSi revealed a wide variation in pore diameter from 14.794 nm to 105.324 nm for the gamma dose increased from 0.5 Gy to 10 Gy. Roughness in the irradiated sample decreased with increase in gamma dose. The change in the structural properties of the irradiated PSi samples is nonlinear while the electrical property is linear with the increase of gamma dose and dependent on the total gamma dose. © 2019 Elsevier Ltd

Author keywords

Atomic Force Microscope | Dislocation density | Gamma irradiation | Gray | p-type porous silicon | Porous silicon | Roughness | Total irradiation dose

Indexed keywords

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