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Ion irradiation induced porosity in Germanium

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Ion irradiation of crystalline germanium (c-Ge) results in the formation of a porous surface, and sometimes buried porous layer. The controlled fabrication of such porous structures has potential applications in lighting, gas detection and catalytic applications. In the present work, we employ a combination of complimentary characterisation techniques to better understand the crystalline-to-porous transformation in Ge as a function of implantation conditions (fluence and temperature). The project is also being extended to include the Si1-x Gex alloy.

Post-implantation optical profiling indicated that significant swelling of the irradiated layer occurs (up to 400 nm), consistent with the formation of a porous surface layer. The optical result also showed evidence of a four stage swelling process with ion fluence for pure Ge, whereas the alloys with different fraction of Ge (90, 80, and 77%) show two different stages of swelling (up to 100 nm). It has been observed by utilizing Raman spectroscopy that the structural properties of the porous layers were also dependent on the ion fluence and temperature as evidenced by changes in the position and width of the characteristic phonon bands. Scanning electron microscopy is also applied to study the morphology as a function of ion fluence and temperature for different concentration of Ge. The pore shape and depth damage distribution has been investigated by using Transition electron microscopy. Small angle x-ray scattering measurements provided further evidence of an implant temperature-dependent.

Keywords or phrases (comma separated)

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Summary

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