

Fabrication of nanoporous silicon by ion implantation

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Abstract

© Springer Science+Business Media Dordrecht 2015. Ion implantation is an advanced new technological method for the fabrication of nanoporous silicon material with metal nanoparticles. The methodology of this technique is developed by Ag⁺-ion implantation with an energy of 30 keV and a dose of $1.5 \cdot 10^{17}$ ion/cm² into a polished monocrystalline silicon substrate. By using Raman spectroscopy, SEM and AFM measurements it is found that amorphous layers of porous silicon (PSi) with an average size of the porous holes on the order of 150–180 nm, a depth of about 100 nm and a wall thickness of about 30–60 nm are formed on the Si surface as a result of ion irradiation. Ion implantation is also applied to locally modify the surface of Si to create periodic plasmonic PSi microstructures with Ag nanoparticles with a diameter of 5–10 nm. The results obtained clearly demonstrate how low-energy ions can be used for the fabrication of photonic microstructures on Si surfaces in a single-step process, similarly as it was recently done for Cu⁺-ion implanted silica glass.

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Keywords

Ion implantation, Nanoporous silicon, Silver nanoparticles