Russian Microelectronics 2015 vol.44 N8, pages 546-551

# Synthesis of porous silicon with silver nanoparticles by low-energy ion implantation

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## Abstract

© 2015, Pleiades Publishing, Ltd. In this paper, a new technique is proposed for synthesis of porous silicon (PSi) layers with silver nanoparticles based on the method of low-energy high-dose metal ion implantation into Si. In order to demonstrate this technique, the implantation at room temperature of a polished Si wafer by Ag+ ions with the ion energy of 30 keV, ion dose of 1.5 × 1017 ion/cm2, and ion current density of 8 μA/cm2 is carried out. Using methods of high resolution scanning electron and atomic-force microscopy, electron probe microanalysis, and Raman scattering, it is shown that ion implantation results in the formation, on the surface of irradiated Si, of a thin amorphous layer of PSi with the average pore size of 150–180 nm, a pore depth of about 100 nm, and wall thickness between pores of about 30–60 nm. Moreover, the PSi structure contains Ag nanoparticles 5–15 nm in size. It is established that, during the ion implantation, the sputtering of the Si surface by Ag+ ions takes place, which was not observed previously. Based on the data obtained, it is concluded that, in contrast to chemical techniques, the proposed physical technique for PSi formation can be integrated into the modern advanced process of fabricating and improving electronic circuits based on industrial ion implantation.

http://dx.doi.org/10.1134/S1063739715080028

## Keywords

amorphization, ion implantation, porous silicon, silver nanoparticles, surface sputtering