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Fabrication of composite based on GeSi with Ag nanoparticles using ion implantation

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Abstract

© 2016, Pleiades Publishing, Ltd.Comparative analysis of the structural and optical properties of composite layers fabricated with the aid of implantation of single-crystalline silicon (c-Si) using Ge+ (40 keV/1 × 1017 ions/cm2) and Ag+ (30 keV/1.5 × 1017 ions/cm2) ions and sequential irradiation using Ge+ and Ag+ ions is presented. The implantation of the Ge+ ions leads to the formation of Ge: Si fine-grain amorphous surface layer with a thickness of 60 nm and a grain size of 20–40 nm. The implantation of c-Si using Ag+ ions results in the formation of submicron porous amorphous a-Si structure with a thickness of about 50 nm containing ion-synthesized Ag nanoparticles. The penetration of the Ag+ ions in the Ge: Si layer stimulates the formation of pores with Ag nanoparticles with more uniform size distribution. The reflection spectra of the implanted Ag: Si and Ag: GeSi layers exhibit a sharp decrease in the intensity in the UV (220–420 nm) spectral interval relative to the intensity of c-Si by more than 50% owing to the amorphization and structuring of surface. The formation of Ag nanoparticles in the implanted layers gives rise to a selective band of the plasmon resonance at a wavelength of about 820 nm in the optical spectra. Technological methods for fabrication of a composite based on GeSi with Ag nanoparticles are demonstrated in practice.

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