EPR AND OPTICAL STUDY OF SiO_2 FILMS IMPLANTED WITH GERMANIUM IONS

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S u m m a r y

Electron paramagnetic resonance (EPR) and photoluminescence (PL) have been used to study SiO_2 films grown by thermal oxidation of silicon substrates and possessing either a homogeneous distribution or that close to a Gaussian one of implanted Ge atoms. The E'_γ centers connected with oxygen vacancies in SiO_2 and the defects induced by replacing Si atoms in the matrix sites by Ge ones have been identified as dominant paramagnetic defects. Among the latter, the Ge E' and Ge(2) centers, as well as the germanium peroxy radical Ge PR, have been recognized. The fact that the concentration of defects in specimens with a homogeneous distribution of Ge atoms was an order of magnitude lower than that in specimens with a Gaussian distribution has been explained by a dynamic annealing of defects during the multiple implantation. The revealed correlation between the intensity variations of EPR spectra and PL bands peaked at 1.94, 2.00, and 2.20 eV, which took place at annealing, testifies to that those bands are of the defect nature. At the same time, the PL band with a maximum at 2.32 eV, which appeared after annealing at 900 °C, has been connected with the formation of Ge nanocrystallites in SiO_2.