TRANSFORMATION OF THE STRUCTURE OF SILICON OXIDE DURING THE FORMATION OF Si NANOINCLUSIONS UNDER THERMAL ANNEALINGS

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S u m m a r y

The composition and the structure of SiO_x films (x = 1.16, 1.3, and 1.6) as functions of the annealing temperature (600–1100 °C , 15 min, Ar atmosphere) are studied by infrared (IR) spectroscopy, photoluminescence (PL), and X-ray photoelectron spectroscopy (XPS). A correlation between the type of a structure (amorphous or crystalline) of Si nanoinclusions and the composition of the Si oxide matrix is found. Amorphous Si nanoinclusions are formed in the understoichiometric Si oxide matrix (SiO_x, $0 < x < 2$), while the formation of SiO_2 inclusions takes place under the Si nanocrystal formation. A physical model considering both a change of the chemical potential of amorphous Si with the temperature and the temperature-dependent crystallization of nanoinclusions is proposed to explain the observed correlation.