Nanostructural surfaces

Influence of magnetic field on the structural and optical properties of silicon crystals for solar energy

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The problem of interaction between field and matter is one of the fundamental problems of solid state physics. The literature has been considered the influences of magnetic fields on the physical properties of magnetic materials. The goal of this work was to find magnetosensetive effects in "non-magnetic" Si crystals for solar energy. The studies using the method of ellipsometry revealed decrease in the optical conductivity in "solar" silicon (s-Si) samples after exposure in a constant magnetic field with induction B = 9 T during 4 days.

It was found that the magnetic action leads to a decrease on 0.05 refractive index of s-Si crystals. These changes in the optical characteristics may be associated with the appearance of amorphous inclusions in near-surface layer of single-crystal s-Si samples, which were magnetic treatment. According to developed model representations in literature, the magnetic field induces a process of singlet-triplet conversion in complexes of point defects. This process leads to the breaking of chemical bonds resulting of the growing number chemically-active adsorption centers. According to our assumptions adsorption of water molecules, hydrogen, oxygen should be on these adsorption centers. These assumptions have been confirmed by the study of the changes EPR spectra of s-Si crystals after magnetic treatment. It was found that the magnetic action leads to an increase in the amplitude of the EPR signal associated with radical type ≡Si● and ≡SiO●. The studies using the method of ellipsometry and X-ray photoelectron spectroscopy revealed effect of growth ~ 2 times natural oxide film which correlates with the appearance of radical ≡SiO●. Thus, reduction of the refractive index in s-Si crystals caused by magnetic action and detected by the method of ellipsometry associated with the formation on the surface of additional amorphous oxide layer.