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Effect of elastic deformation and the magnetic field on the electrical conductivity of *p*-Si crystals

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A characteristic feature of resistance dependence of *p*-Si sample on the value of its elastic deformation (R (σ)) is the decrease of resistance under compression and the increase of resistance under unclasping during one cycle of deformation. With increasing numbers of cycles, the difference between the position of compression and unclasping curves decreases.

Although the so-called "dislocation-free" samples were used, the deformed layer up to 1 micron in thickness that is enriched with loop-shaped dislocations was formed under the deposited Al film. In case of the deformation, these dislocation loops extend deep into the crystal and capture point defects. Under the unclasping the dislocations bring points defects to the surface layer.

Stable and non-inertial factor should be taken into consideration while explaining $R(\sigma)$ dependences. This factor is a distortion of energy bands under the deformation of silicon lattice. As a result, the silicon conductivity increases through the decrease of the effective mass of “heavy” holes. This factor explains practically unchangeable values of conductivity of the sample a long time in deformed and not deformed state. However, if only this factor acted, the curves $R(\sigma)$ would have coincided under compression and unclasping.

The conversion of two types of magnetotactic defects occurs in a magnetic field in the *p*-Si crystal. The defects are associated with two factors that cause the opposite effect on the conductivity of the crystal. The first factor it that under the influence of a magnetic field decreases the activation energy of dislocation stoppers, which increase the electrical conductivity of the sample in a magnetic field. The second factor is that the stable chemisorbtion related relationships appear in the crystal and lead to the decrease in its conductivity due to the collapse of oxygen-containing molecules of impurities in the magnetic field.

The resistance of sample has not changed its value during a long time without a magnetic field while in a magnetic field the resistance fluctuated around certain value. The frequency of changes is bigger in the deformed sample.