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# PLASTICITY OF THE Si SINGLE CRYSTALS OF *n*- AND *p*-TYPES IN THERMAL AND ELECTRICAL FIELDS

In single crystals of silicon of *n*- and *p*-type, the peculiarities of deformation characteristics under conditions of both joint action of electrical and thermal fields and electric current only are tested. There is a small increase in specific resistance of Si with increasing pressure applied. For the *p*-Si samples under combined action of thermal field and electric current at compression (combined plastic deformation – CPD), an increase in resistance to deformation was found, while under the influence of electric current only (electroplastic deformation – EPD), an increase of plasticity was detected. Samples of *n*-Si demonstrated an opposite effect: under combined action of the thermal field and electric current, compression enhances plasticity, while under the influence of the electric current only, an increase of the strength properties occurs. The resistance to deformation dramatically increases in the conditions of hot plastic deformation (HPD); in this case the sample is compressed under the influence of the thermal field only. When compared with efficiency and EPD load and temperature, it is impossible to achieve substantial magnitude of plasticity in the process of the HPD. Surface microstructure of the deformed samples were studied. They noticeably differ in morphology and distribution of dislocations on the surface. Impact efficiency and EPD effect on the electrical properties of the *n*- and *p*-Si semiconductors, results in a change in resistivity compared to the original model: *n*-Si demonstrates the growth of the resistivity, and *p*-Si resistivity drops. With an efficiency, the resistivity varies stronger than at EPD. Possible physical explanation of the observed phenomena is suggested.

**Keywords:** silicon, plasticity, dislocations, thermal field, electrical field

**Fig. 1.** Applied mechanical stress σ dependence of the conductivity 1/ρ for *p*-Si (*1*), *n*-Si (*4*) in terms of efficiency and *p*-Si (*2*), *n*-Si (*3*) under EPD at $T = 760°C$ for 25 min

**Fig. 2.** Photos of the surface of the Si single-crystals of *p*-type (I) and *n*-типа (II) subjected to: *a* – CPD (the density of dislocations ~ $1.7 \cdot 10^3$ cm$^{-2}$), *б* – EPD (the density of dislocations ~ $1.0 \cdot 10^4$ cm$^{-2}$) at $T = 760°C$ and $t = 25$ min; (×500)