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DISTRIBUTION OF THE DEFECTS IN THIN SEMICONDUCTOR PLATES AT LOW-TEMPERATURE DEFORMATION

This paper shows the possibility of evaluation of the degree of imperfection of the Ge plate in a complex stress-strain state by measuring the lifetime of minority carriers τ. The plates of monocrystalline Ge of *n*- and *p*-type in the form of 0.8 × 4 × 17 mm in size oriented along the [111], [112] and [110] directions were tested. Deformation was performed by three-point bend at σ_m = 80 MPa for 24 h. The temperature of the sample during experiment did not exceed 310 K.

The focus was on evaluation of the degree of imperfection near the supports (stress concentrators) of the deformed plate. The distribution of the total stress σ near the point of force application was found with account of the effect of normal σ_x and horizontal σ_y components of the radial pressure. It is noted that at the chosen conditions, the excess of deformation stresses in the Ge crystal in area of the supports is substantial at the depth up to 25 μm and the distance of < 1.2 mm along the surface of the support. The performed theoretical calculations of stresses are in qualitative agreement with the distribution of the introduced structural defects in the surface layer and the electrical measurements of the structure-sensitive properties of the defect layer.

The used probe method for measuring τ allows a high level of local measurements and can be recommended for the control of the degree of imperfection in small fragments of integrated circuits in a production environment.

Fig. 1. Scheme of deformation of a plate by three-point bending (*a*) and distribution of the defects near the concentrators (*б*): *1* – Ge sample, *2* – acoustic radiator

Fig. 2. Stress distribution in the plate under the action of a concentrated force *F*

Fig. 3. Dependence of the total stress at the site of force application *F* at the distance *x* along the surface and deep into of the plate (the distance *y*, μm is marked on the curves)

Fig. 4. Dependence of lifetime τ_l of nonequilibrium charge carriers in the defect layer vs the distance *x* along the upper (*1*) and the lower (*2*) surfaces of the Ge plate: the points *a*, *c*, *e*, *f* mark the maximum concentration of defects in the surface layer; the points *b*, *d* mark unimportant structural defects. The inset shows the optical images of deformation defects