STUDY OF THE ELECTRICAL PROPERTIES OF p-Si<Cu> SAMPLES

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Abstract: Currently, the study of the influence of impurity atoms on the electrical properties of semiconductor materials is of particular importance [1-11]. This paper presents the results of studies of the electrical properties of p-Si<Cu> samples. Single-crystalline silicon of the KDB-0.3 grade, grown using the Czochralski method, was used as the initial sample. Diffusion was carried out at temperature T=1473 K for t=1.5 hours.

Figure 1 shows the dependences of the resistivity - ρ of p-Si<Cu> samples with fast (200 K/s) and slow (1 K/s) cooling at a temperature T = 80÷320 K. As you can see, the

value of ρ in slowly cooled samples with increasing temperature from 80 K to 120 K ρ gradually increases and reaches 35 Ohm·cm (Fig.1, curve 2). In this temperature range the value of ρ in rapidly cooled samples, p-Si<Cu> remains almost unchanged (Fig.1, curve 1). When the temperature increases from 120 K to 240 K, in slowly cooled samples a sharp decrease in the value of ρ is observed by almost 1 order of magnitude, and in samples with rapid cooling the value of ρ also decreases to 0.8 Ohm·cm. With a further increase in temperature to 320 K, the value of ρ remains almost unchanged.

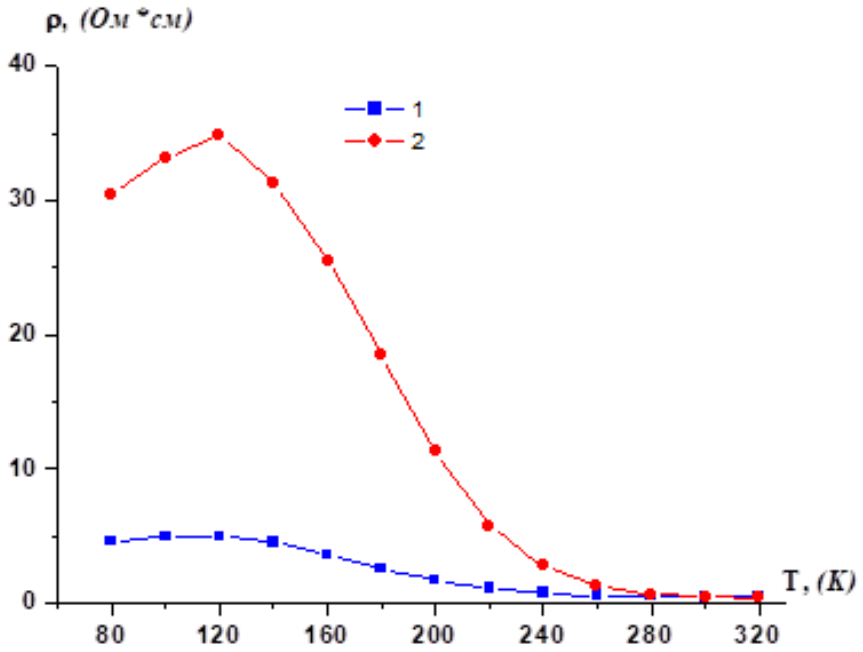

Fig.1. Temperature dependence of resistivity of p-Si<Cu> samples.

1- rapid cooling, 2- slow cooling.

In Fig.2 shows the temperature dependence of the charge carrier concentration – n for p-Si<Cu> samples with fast and slow cooling. As can be seen in the temperature range T = 80÷120 K in samples with rapid cooling, the value of n almost does not change and amounts to $5 \cdot 10^{15}$ cm^{-3} (Fig.2, curve 1). In this temperature range, in samples with slow cooling, the value of n decreases by almost 7 times (Fig.2, curve 2). With a further increase in temperature to 320 K, for samples with both slow and fast cooling, an increase in the value of n is observed. In samples with rapid cooling it increases by 13 times, and in samples with slow cooling it increases by almost 20 times.

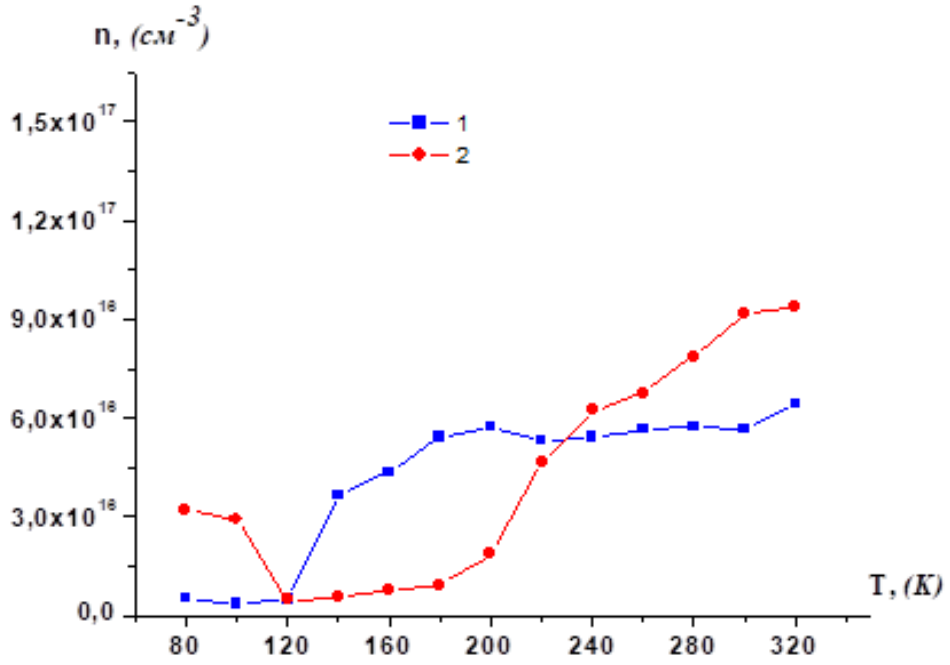

Fig.2. Temperature dependence of charge carrier concentration in p-Si<Cu> samples.

1- rapid cooling, 2- slow cooling.

Thus, the nature of the change in the values of ρ of p-Si<Cu> samples with slow cooling, at temperatures T = 80 ÷ 320 K, is mainly associated with the formation of various impurity accumulations with the participation of Cu and B atoms during the cooling of the samples after diffusion, which are in an electrically neutral state. With an increase in temperature from 120 K to 320 K, the observed decrease in the value of ρ of the samples occurs due to an increase in the concentration of charge carriers, as well as an increase in their mobility.

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