KINETICS OF PHOTOCONDUCTIVITY OF $CuGaSe_2$(Zn,Ge) CRYSTALS

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$Cu(In_x,Ga_{1-x})Se_2$ compounds are regarded to be promising materials to be used as optically active layers in thin-film solar elements of the last generation.

We studied the kinetics of $CuGaSe_2$(Zn,Ge) crystal photoconductivity using standard methods. The equipment included a source of optical emission, a modulator used for rectangular light pulse formation and a diaphragm for the restriction of flow intensity. The sample was placed into a circuit containing a DC power and a loading resistor, the signal of which was registered by an oscillograph. The measurements were made at T = 300 K.

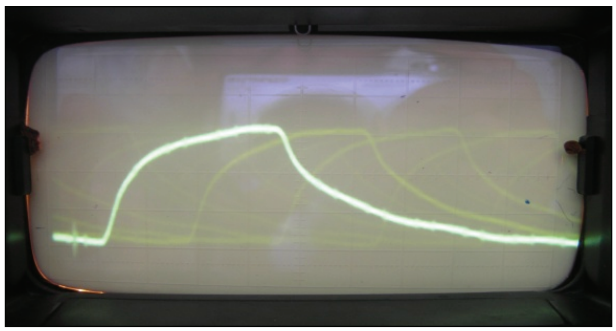

Fig. 1. Typical relaxation curve.

The kinetic curves were registered at different emission intensity. Their analysis showed that the photoconductivity kinetics in the given crystals cannot be described by linear or square-law charge carrier recombination mechanisms and has a complicated nature (Fig. 1).

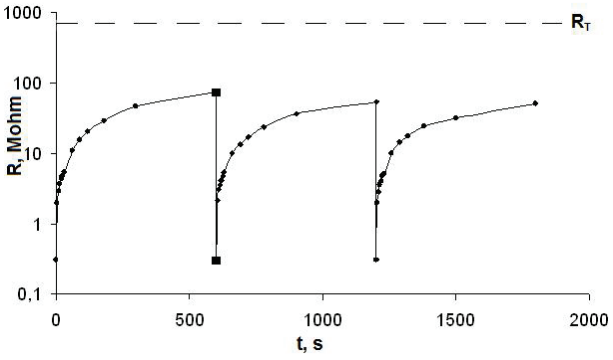

Fig. 2. Time dependence of resistance at initial and subsequent flare of the sample.

The phenomenon of long-term (about ten hours) photoconductivity relaxation of $CuGaSe_2$(Zn,Ge) crystals was found.

The sample in the cryostat (T = 77 K) was exposed to red LED (λ = 640 nm). After the exposure stopped, the dependence of the current upon time was registered; afterwards, the sample was exposed again, and the cycle of measurements was repeated. Heating of the sample up to 300 K with subsequent cooling down to 77 K in the darkness brought the sample into the initial condition (Fig. 2).

Possible reasons for this kind of long-term photoconductivity relaxation of $CuGaSe_2$(Zn,Ge) crystals are shallow traps and surface states.

References

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