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An evidence of strong electron-phonon interaction in the neutron irradiation induced defects in silicon

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It is known an investigation of photoconductivity dependence on excitation photon energy can be used for the deep level spectrum analyze, but an accurracy depends on model that is chosen for the analyze.
In this work the temperature dependence of photoresponse spectrum was investigated in the silicon single crystal samples irradiated by neutrons to fluence up to 3e16 cm-2. Due to a rather long photoresponse time constant a new differential photoresponse spectrum analyze method was used for the deep levels near to the valence band energy measurement.
The slow transient dependence of photoresponse during the excitation and during decay, and it dependence on additional excitation permitted to propose the deep level competition processes and a role of cascade type excitation of free carriers.
Slow relaxation processes also were observed during measurement of galvanomagnetic effects that was analyzed in terms of modulation of conductivity band bottom by clusters.
The modeling of bias voltage influence on the contribution of the cluter related potential modulation demonstrated a possibility to avoid this effect at high bias.

Summary

The photoresponse spectral dependence at different temperature permitted to analyze the proprties of deep level related to the radiation induced cluster, and by the data observed in transient behavior of photoresponse to propose the nature of slow relaxation observed in Hall and magnetoresistance effects.

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