EXCITON-ENHANCED RECOMBINATION IN SILICON AND ITS EFFECT ON SEMICONDUCTOR DEVICE PERFORMANCE

A. V. Sachenko, A. P. Gorban, V. P. Kostylyov

Institute of Semiconductor Physics,
Nat. Acad. Sci. of Ukraine
(*45, Nauky Prosp., Kyiv 03028, Ukraine*)

S u m m a r y

The results of investigation of room-temperature recombination processes occurring in silicon at high concentrations of charge carriers are reviewed. These results testify to the essential role of nonradiating Wannier – Mott exciton annihilation occurring as Auger-type recombination with participation of deep impurity centers. It is shown that the mentioned effects are especially significant in n-type silicon and result in an essential decrease of the bulk lifetime at doping concentrations exceeding $10^{16}\,\mathrm{cm}^{-3}$. The influence of exciton-related recombination on the performance of silicon-based p-n-junctions and solar cells is analyzed. It is shown that the rate of such a recombination essentially increases with a decrease in temperature.