A nature of phase transformations in Relaxed Optics

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The problem of phase transformations is one of the central problem of Relaxed Optics (RO) [1]. It is connected with problem of saturation of laser-induced excitation of proper centers of light scattering and further relaxation of its excitation. For case of radiative relaxation we have intensive luminescence or lasing effect. For case of non-radiating relaxation we have proper phase transformations in irradiated materials. The problem of macroscopic phase transformations, including phase transitions, in RO is connected with problem of accumulation of proper changes in local ranges and further abrupt or smooth transition to new macroscopic phase. Abrupt phase transitions in RO may be have kinetic and dynamic nature [1]. For example, it are realized for the nanosecond Ruby-laser irradiation of InSb (effect of laser implantation). Smooth phase transitions are corresponded to the positive effects of laser annealing of ion-implanted layers if Si with wavelength 1,06 μm and InSb with wavelength 10,6 μm [1].

First type of phase transformations is corresponded to strong time-ordering step-by-step multiphotonic absorption of laser radiation. This multiphotonic absorption is caused the step-by-step saturation of excitation of proper chemical bonds for InSb or other materials [1]. For explanation and modeling of these results two-dimensional lattice of sphalerite was used for InSb and phase diagram for Si.

Second type of phase transitions are slow transitions because it correspond to transitions from unstable or metastable phase to stable phase. Basic process is the the accumulation local transformations, which aren't depended from time regimes of irradiation. We have pure photochemical processes.

For more detail research other phase transformations in RO, including creation laser-induced nanostructures, we must include surface and interphasic conditions of real processers.

[1] P. Trokhimchuck. Foundations of Relaxed Optics. - Lutsk: Vezha, 2011. - 627 p.