"OPTICAL STUDIES OF INSULATING NANOCRYSTALS DOPED WITH RARE EARTH AND TRANSITION METAL IONS"

Abstract. The review of optical studies of rare earth and transition metal ions doped nanocrystalline insulating materials is presented. The effects of spatial confinement on the dynamical properties of the excited states of impurity ions in insulating nanocrystals were studied. The mechanisms responsible for these effects may be grouped into two categories: (i) those connected with size quantization of vibrational states and (ii) those caused by the interaction of impurity ions with the nanocrystals surface states and the environment surrounding the crystallites. The fluorescence spectroscopy of probe impurity ions was also used for studies of the structure of nanocrystalline systems and of transformations that occur in these systems. The following experimental results are discussed:
1. Effects of the modified phonon density of states in nanocrystals and of interaction of impurity ions in nanocrystals with the surrounding media on the low-temperature dephasing of electronic states of impurity ions.
2. Effects of spatial confinement on nonradiative relaxation between closely spaced electronic levels in free-standing nanocrystals and nanocrystals embedded in amorphous media.
3. The dependence of radiative lifetimes of the excited states of impurity ions in nanocrystals on the surrounding media.
4. Spectroscopic monitoring of nanocrystals formation (nucleation) in the course of isothermal annealing of glass.
5. Studies of ferroelastic and ferroelectric phase transitions in insulating nanocrystals with optical methods.

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