LASER SPECTROSCOPY of Nd^{3+} IONS OPTICAL SITES in HYDROXYAPATITE MICROPOWDERS

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During the past years the interest in the study of hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$), is associated primarily with their compatibility with human biological tissues. Currently, synthetic hydroxyapatite (CHAp) is used in many areas of biomedicine, such as traumatology, orthopedics, dentistry, etc. [1,2]. Doping of nanocrystals with fluorescent rare-earth (RE) ions allows one to control their crystallinity using the energy transfer probing [3]. This method is based on the analysis of the kinetics of impurity fluorescence quenching. The main advantages of the method are non-invasiveness, as well as higher sensitivity compared to other known methods for studying the crystal structure.

Since the energy transfer probe method is based on the analysis of quenching kinetics of fluorescent donor, it is needed to distinguish different optical sites of RE ions in the crystal matrix. It was shown in [4] that there are two positions of Ca^{2+} in CHAp with different symmetry: Ca (I) - C_3 (OC1) and Ca (II) – C_S (OC2), which can be replaced by RE^{3+} ion. Here, with site-selective and time-resolved kinetics spectroscopy of CHAp micro particles at liquid helium temperature (10°K) we have confirmed two types of optical centers of the Nd^{3+} ion in doped CHAp. Their selective luminescence spectra and kinetics were measured, and spontaneous emission decay times were determined. An energy level diagram for each type of optical centers was built. According to kinetics of impurity quenching found and the energy level diagrams, an energy transfer from OC (I) to OC (II) is revealed.

References

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