BIOCERAMIC MATERIALS AND ITS APPLICATION IN MEDICINE

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ABSTRACT

During the past decades, lanthanide-doped nanoparticles (including upconverting particle) have been widely investigated due to the benefits related with their unique luminescent properties [1, 2]. Especially, Gd^{3+}-containing nanocrystals have received much attention due to the possibility of applying these materials as contrast agents in biomedicine for magnetic resonance imaging. This is due to the paramagnetic properties of Gd^{3+} ions due to the seven unpaired 4f layer electrons. By simultaneously inserting light-emitting lanthanide ions into the matrices of gadolinium compounds, an efficient, multifunctional nanomaterial with luminescent and magnetic properties is obtained. One such substance is gadolinium phosphate, which is widely studied for its bioavailability due to the phosphate moieties on the crystal surface [3]. With size around 100 nm it as a potential candidate for being a contrast material during magnetic resonance imaging. Doping by europium causes the orange-red light emission of Eu^{3+} ions, which might be used in luminescent imaging as well [4]. However, $GdPO_4$ has multiple crystallographic structures [5, 6] and many possible particle shapes, meanwhile its properties are dependent on the shape, size, and structure.

The $Gd_{1-x}La_xPO_4$:Eu · nH_2O compounds of monoclinic and hexagonal crystal structures were synthesized by hydrothermal, solid state, and co-precipitation methods. In order to determine phase purity and the structure itself at room temperature X-ray measurements were performed. Phase transition temperature and the amount of water in the compound were analyzed with high temperature in-situ X-ray diffraction analysis and TGA. Shape and size of particles were measured with TEM and SEM analysis. The dependence of luminescence properties on the amount of doped Eu^{3+} of hexagonal nanorods and cytotoxicity test were also investigated.

References

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