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LuAG:Pr3+ - BASED NANOHYBRID SYSTEMS FOR SINGLET OXYGEN GENERATION

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With LuAG:RE³⁺ (RE = rare-earth elements) single crystal and fiber applications in many fields of scintillator industry, including high-energy particle physics, medical imaging and security measures [1], there is a growing interest in the LuAG:Re³⁺ powders. Due to the luminescence properties and very high chemical stability, such powders may be used as a light-emitting core of the nanocomposite material for X-ray induced photodynamic therapy (PDTX) [2]. PDTX uses tumor-destroying agents based on the nanoparticles (NP) conjugated with photosensitizer (PS) molecules. The agent accumulates preferentially in the target cells; subsequently, the external X-ray irradiation excites the scintillating NP, emitting secondary radiation, which activates the PS molecules. Their deexcitation via non-radiative energy transfer (ET) leads to the production of the reactive oxygen species, where the singlet oxygen is believed to be the most cytotoxic one [3].

Due to the suitable luminescent properties, especially the overlap of Pr³⁺ emission and protoporpyrin IX (PpIX) absorption bands, LuAG:Pr³⁺ may be a good candidate for a light-emitting core of the PDTX agent. In this work, we present a concept of preparation of the singlet oxygen producing LuAG:Pr³⁺@SiO₂-PpIX nanocomposites for PDTX application. LuAG:Pr³⁺ nanoparticles with the average size of about 25 nm were prepared using photo-induced method [2]. Subsequently, the surface coating procedure with SiO₂ amorphous layer was performed via combined two-step sol-gel/dense liquid coating process. Finally, NPs were conjugated with a photosensitizer molecule (PpIX). Morphological characteristics of the materials were obtained from the X-ray diffraction analysis (XRD) and transmission electron microscopy (TEM). Energy transfer (ET) and luminescent properties of the nanocomposites were studied by radioluminescence (RL) and photoluminescence (PL) spectroscopies.

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