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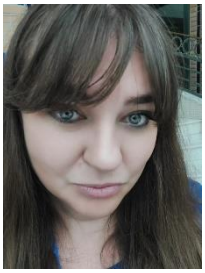

The Approaches to The Synthesis of Oxyfluoride Glass Ceramics

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Biography

I received the Ph.D. in Technology of silicate and refractory non-metallic materials in 2010. My studies have mainly focus on the development, synthesis, and investigations of the glass, glass-ceramics, and ceramics. The synthesis methods based on the melt-quenching technique and colloid-chemical approaches are the main techniques used in the work. My last studies have focused on the synthesis and investigation of luminescent materials in form glass glass ceramics and glassfiber. The results have published in ranked international journals.

Abstract

The composite glassy materials, based on nanoparticles embedded in a glass matrix, have attracted the attention of scientists due to the unique physical phenomena associated with electron quantum confinement and unusual nonlinear optical response. Furthermore, from this perspective, fluoride glasses offer several advantages, including a low melting and softening point, as well as high ultraviolet transmission compared to conventional silicate oxide glasses. Oxyfluoride glasses based on SiO_2–GeO_2–PbO–PbF_2–CdF_2–YbF_3 system co-doped Ho_3+, Tm_3+ and Er_3+ have gained the trust of researchers as a good matrix for nanoparticle-based rare-earth ion systems. These nanostructured glassy materials exhibit higher quantum efficiency in up-conversion luminescence, a phenomenon where optical emission occurs through cooperative energy transfer among different optically active ions. The distinct temperature treatments of doped oxyfluoride glasses are an efficient way to structurally modify optical nanoparticles. This corresponds to the crystallization of initially amorphous PbF_2 nanoparticles and the formation of up-conversion luminescent nanostructured centers. It was indicated a two-stage process for the formation of up-conversion luminescent nanoparticles in the composite glasses. At the first stage, relatively large amorphous nanoparticles of lead fluoride form in a glass matrix, and it is assumed that rare earth ions are then introduced into these amorphous nanoparticles. During the second stage, when temperature treatment is applied above 380°C, there is a gradual change in size and morphology of the original amorphous particles. It was assumed this is due to crystallization processes occurring during temperature treatment. In the presented work, we tested this assumption on glasses with up-conversion luminescent nanoparticles. Interestingly, this crystalline phase formation is observed when several rare earth oxides are present simultaneously.