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$GdPO_4$/Eu/Yb-Tm BASED PHOSPHOR SYNTHESIS AND ANALYSIS

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Over the last couple of decades, biocompatible multifunctional magnetic and luminescent nanoparticles have received a lot of attention. Due to their possible applications in magnetic resonance and luminescent imaging, as possible drug carriers etc [1]. Most of these inorganic nanoparticles are rare-earth based materials due to their excellent magnetic and optical properties. Also, some of them are good host materials for dopant ions. One such material is $GdPO_4$ because of the phosphate groups on its surface that make it biocompatible and stable [2]. Gd^{3+} ions have 7 unpaired 4f electrons resulting strong paramagnetic properties. Thus, the samples containing Gd^{3+} ions are potential candidates for magnetic resonance imaging. Further gadolinium phosphate can be easily doped with other rare earth elements to make it a luminescent material as well. Europium is commonly used as a dopant because of its long decay times, narrow emission bands and orange-red light emission [3]. Other elements or even a combination of several dopants can be also used to make an upconverting system [4]. However, the particles for bio applications have to be smaller than 100 nm in size, not agglomerated, and must be stable and have high luminescence intensity. Ions from the compounds must not leech into the organism. The small size of particles usually leads to low luminescence intensity but it can be increased by forming a core-shell system [5]. Also, $GdPO_4$ particles of different size, shape and even of several crystal structures can be prepared. All of these factors influence the stability, as well as magnetic and luminescence properties. They can also affect the toxicity of the compound to the cells. For this reason, a lot of research is still required.

In this work, rare-earth doped gadolinium phosphate was prepared using citric acid assisted hydrothermal synthesis. Effects of synthesis conditions and dopants were investigated. X-ray diffraction analysis was used to determine thermal stability and purity of obtained samples. Scanning electron microscopy and transmission electron microscopy were used to determine the shape and size of particles. Luminescence measurements of particles and their solutions were performed. Thermal gravimetric measurements were used in order to find the amount in the crystal hydrate.

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