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# Upconverter phosphate glasses prepared using direct doping method

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## Abstract

Laser glasses are glasses doped with rare-earth (RE) elements. Since the invention of the first solid-state laser in 1960, many important successes have been achieved in diode laser pumped solid-state lasers, followed by the blooming research for new laser glasses. A major research focus in laser glasses is glass for upconversion. Upconversion (UC) is a phenomenon where the serial absorption of two or more photons causes light emission at shorter wavelength than the excitation source. Phosphate glasses could be good glass candidates due to their *eco-friendly* compatibility. However, these glasses have a large phonon energy, which is disadvantageous to the UC emission

Therefore, we investigate new phosphate-based glass composites to be used as soft upconverters.

In this presentation, we will demonstrate that upconversion can be obtained in phosphate glass composites which contain a low doping level of Er<sup>3+</sup> (0.01 at%) and Yb<sup>3+</sup> (0.06 at%). This achievement is possible by adding Er<sup>3+</sup>, Yb<sup>3+</sup> codoped nanoparticles (NPs) in the glasses using direct doping process. We will explain that it is crucial to control the melting process in order to balance the survival and dispersion of the particles in the glass composites. Finally, we will demonstrate that the corrosion behavior of the glass melt is another important parameter to consider in order to engineer new glass composites using this direct doping method.

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**Keywords:** phosphate glass, NaYF<sub>4</sub>:Yb, Er particles, direct doping method, upconversion

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