

In the realm of luminescent materials, a groundbreaking research project unfolds at the intersection of glass science and luminescent phosphors. The project's focus is on Phosphor-in-Glass (PiG) composites, where the challenge lies in balancing the efficiency of luminescent crystalline particles with the loss of transparency and light extraction caused by refractive index mismatches. The central hypothesis asserts that achieving a match between the refractive indices of the crystalline phosphor and the glass matrix holds the key to ensuring transparency in luminescent composite materials.

The motivation for this research stems from the promising potential of PiG composites, the attainability of the research goal, the fundamental need for exploration, and the anticipated substantial impact on various technological applications in photonics and optoelectronics. Previous studies indicate that modifying the chemical composition allows control over the refractive index within specific ranges for both glass materials and polycrystalline phosphors. Several research groups have demonstrated the feasibility of refractive index matching.

To achieve the project's objective, a comprehensive research plan unfolds, encompassing the study of glass matrix materials and polycrystalline phosphors. The plan involves the preparation of tellurite, lanthanum borate, and barium borate glasses with controlled refractive indices, as well as polycrystalline aluminate and phosphate solid-solution phosphors. Transparent luminescent composites will be crafted using innovative methods such as the remelt, direct-doping, and co-sintering techniques.

The characterization of developed materials will employ an arsenal of techniques, including differential scanning calorimetry (DSC), infrared (IR) and Raman spectroscopy, X-Ray diffraction (XRD), and UV/VIS luminescence spectroscopy. The refractive index of samples will be meticulously assessed using an Abbe Refractometer and the Becke line method for glass and polycrystalline samples, respectively. Collaborating with Tampere University's Photonic Glasses Group in Finland, a leading research group in glass science, this project not only promises cutting-edge advancements in luminescent materials but also signifies the potential for transformative international collaborations in the pursuit of scientific excellence.