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Luminescence from ZnO Nanomaterial due to Defect Centers

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The potential of Zinc oxide (ZnO) nanophosphor material as a host for optoelectronic applications was investigated in this study. ZnO nanoparticles were synthesized using the co-precipitation method, followed by sintering at a maximum temperature of 700℃ in air. The sintering process was carried out in a custom-made temperature-controlled muffle furnace with a precision of ±1℃, reaching a maximum temperature of 1200℃. All sintered powder samples underwent characterization using XRD, SEM, FTIR, UV-VIS, and photoluminescence (PL) techniques. XRD analysis confirmed the formation of nano-material with a hexagonal wurtzite phase. SEM images revealed the spherical shape of the prepared particles, which tended to agglomerate at higher temperatures. FTIR spectroscopy indicated absorption at 430 cm^(-1), corresponding to the Zn-O (metal-oxygen) bond, confirming the formation of ZnO. UV-VIS analysis exhibited strong band-edge absorption in the UV region, particularly around 370 nm. Photoluminescence studies, conducted with various excitations of UV light, demonstrated broad emission in the visible region attributed to defect centers in ZnO. This investigation explores the potential of ZnO to serve as an effective host material. The anticipation is that, when doped with a suitable metal, ZnO will exhibit broad emission ranging from 400 to 700 nm, making it a promising candidate for a white light source in optoelectronic applications.

Topics

Session B. Laser physics and modern optoelectronics

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