Efficient Infrared Phosphors Powering Tomorrow's Hyper-Speed Optical Networks

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This presentation reports recent advances in near-infrared (NIR) phosphors for optical fiber communications, highlighting three key innovations addressing challenges in telecommunications and shortwave infrared (SWIR) technologies. First, Cr^{4+}-doped garnet phosphors with calcium charge compensation exhibit broadband emission (1100–1600 nm), effectively covering water absorption regions; the $Y_{2.84}Al_{4.9}O_{12}$:Cr,Ca crystal fiber outperforms commercial materials. Second, dual-cation doping (Ca^{2+}/Mg^{2+}) in YAG:Cr enhances NIR-II emission via improved crystal structure and increased tetrahedral Cr^{4+} sites. Finally, a bifunctional $(Ga,Ge)_2O_3$:Cr^{3+},Ni^{2+} phosphor achieves 10.6% internal quantum efficiency with SWIR emission at 1430 nm, enabling both optical amplifier and LED applications. These developments deliver improved efficiency, broader bandwidth, and enhanced thermal stability, advancing next-generation optical communication technologies.

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