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High-Efficiency Dynamic Lighting with Transition Metal Elements as Sensitizers[1] PRAGATHI DARAPANENI, JAMES DORMAN, Louisiana State Univ - Baton Rouge — The lighting industry is going through several unprecedented changes over the past few years for providing energy efficient and low cost lighting. One such change is the development of Light Emitting Diodes (LEDs), which employ rare earth (RE) phosphors of Tb, Er, Eu etc. due to their unique optical and electronic properties. A major concern with the development of RE based LEDs is the availability and cost of these materials as opposed to traditional transition metal (TM) elements. However, TM based luminescence is known to be susceptible to the local crystal environment resulting in a wide range of colors based on the host materials. In this work, we propose a new class of TM based phosphors to maintain LED efficiency while simultaneously controlling luminescence based on the susceptibility of these dopants to external stimuli. For this purpose, Ni^{2+} doped TiO_2 thin films and nanoparticles were synthesized using sol-gel chemistry and annealed for anatase and rutile crystal structures. Standard structural characterization methods were used to ensure Ni^{2+} dopant incorporation into the crystal lattice. The various morphologies and structures showed unique absorption spectra in the visible and NIR region, ideal for TM-RE coupling and the absorption spectra can be systematically controlled via surface functionalization with strong interfacial dipole moments. These results are modeled using time-dependent density functional theory (TD-DFT) simulations in order to design new TM-RE pairs.

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