

4th International Conference and Exhibition on **Materials Science & Engineering** September 14-16, 2015 Orlando, USA

Luminescent properties of powder and pulsed laser deposited thin film phosphors and their applications in lighting, phototherapy and solar cells

Martin Ntwaeaborwa
University of the Free State, South Africa

Phosphors are often used as powders, even though thin films offer higher resolution and better chemical stability. We have investigated structure, cathodoluminescent (CL) and photoluminescent (PL) properties of powders and thin films of several phosphors such as ZnO, CaS:Eu, SrAl₂O₄:Eu²⁺, Dy³⁺; SiO₂:Ce³⁺, Tb³⁺ and ZnO. The thin films were ablation deposited onto Si (100) substrates using either conventional pulsed laser deposition (PLD) or pulsed reactive crossed beam laser ablation (PRCLA). Several deposition parameters were varied, including vacuum versus partial pressure of gas (O₂ or Ar), type of laser pulse, and substrate temperature using excimer lasers. Both the CL and PL intensities were strongly dependent on the deposition conditions and post-deposition annealing. We demonstrated that the photoluminescent (PL) intensity from Ce³⁺ doped in an amorphous SiO₂ matrix was increased by a factor of about ten when five nanometer (5 nm) diameter ZnO was added to the SiO₂ matrix. This is unusual since the energy of Ce³⁺ PL emission (2.7 eV) is larger than that from PL emission from ZnO (2.3 eV). We demonstrated that the energy transfer probably took place by excited electrons moving from Zn-O anti-bonding orbitals to similar orbitals on the Ce³⁺ with a subsequent radiative relaxation towards the ground state. We also demonstrated enhanced ultraviolet B emission for phototherapy lamp application from Gd³⁺ in calcium phosphate host. Mechanisms of energy transfer in different phosphors will be discussed. Finally, the use of ZnO nanoparticles to improve the power conversion efficiency of solution processed organic solar cells will be discussed.

Biography

Martin Ntwaeaborwa completed his PhD from the University of the Free State in 2006. He is the president of the South African Nanotechnology Initiative. He has published more than 150 papers in prestigious journals and has given numerous invited talks at local and international conference. He has received numerous awards including young investigator awards from the South African National Science and Technology Forum and American Vacuum Society in 2009 and 2010 respectively. His research interests are on surface science and luminescent nanomaterials in powder and thin films forms applied to displays, phototherapy and photovoltaics.

ntwaeab@ufs.ac.za

Notes: