

**Looking for red line-phosphors in LED-based systems**

A.A. Setlur, J.E. Murphy, F. Garcia-Santamaria, R.J. Lyons  
 GE Global Research  
 1 Research Circle, Niskayuna, NY 12309  
 N. Prasanth Kumar, N. Karkada  
 GE Global Research  
 John F Welch Technology Centre,  
 122, Phase2, EPIP, Whitefield Road, Bangalore, India

Most red LED phosphors are based upon  $\text{Eu}^{2+}$ -doped hosts and have emission FWHMs  $>80$  nm, leading to significant efficacy losses, especially at high color rendering. Consequently, the development of sharp red phosphors that meet all of the requirements for efficient LED light sources is a key research need for LED phosphors [1,2]. In this presentation, we discuss some of the various routes towards achieving narrow red-line LED phosphors, primarily focusing on non-quantum dot (QD) materials. Within each route, we will discuss positive and negative aspects for these materials as well some of the potential materials and processing challenges. Some topics within red-line phosphors that will be discussed include:

- Host lattice selection to enable high  $\text{Eu}^{3+}$  concentrations without significant concentration quenching [3]
- Routes for sensitizing  $\text{RE}^{3+}$  line emission (i.e.  $\text{Eu}^{3+}$  [4,5],  $\text{Sm}^{3+}$  [6],  $\text{Pr}^{3+}$  [7])
- $\text{Mn}^{4+}$ -doped fluoride hosts [8-10]

Within these various schemes/materials, we will also discuss relevant lamp performance characteristics (in remote phosphor configurations [9]), including reliability, when possible. We will close with a brief discussion around the future outlook for non-QD, narrow red LED phosphors.

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