Abstract

Yttrium aluminum garnet doped with cerium (YAG:Ce) is currently the phosphor of choice for LED lighting applications, due to its broad spectrum emission and relatively high efficiency at common LED operating temperatures. For applications where higher temperatures are reached, such as high-powered LED lighting, a decline in the luminescent efficiency of this phosphor is observed. This phenomenon is referred to as thermal quenching and can be explained by several nonradiative decay processes within the phosphor. This research investigated the luminescent properties of a sample of YAG:Ce with a 2.1% cerium concentration at various temperatures in order to better understand the relationship between temperature and luminescence in this material. Through measurements of continuous luminescence, excitation, and response to pulsed excitation, the properties of this material were determined and compared to previous findings as well as computer models. After fitting this data to various models, and considering previously published research, it was determined that the primary mechanism of thermal quenching in this sample is concentration quenching. By comparing the model for concentration quenching to the experimental data, it was found that, on average, energy transferred between 2.2 cerium ions before ending up in a killer center.