

Frequency conversion in rare earth doped phosphor materials

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Abstract

The rare earth elements are the members of lanthanide series. They are more stable in triply ionized (Ln^{3+}) state. They contain large number of energy levels and many of them are meta-stable. When these ions are doped in the host materials they give intense emissions. They give large emissions in wide range extending from ultraviolet to infrared regions. The rare earth ions are highly sensitive to the ultraviolet and near infrared radiations and on excitations; they give intense upconversion (UC), downconversion (DC) and quantum cutting (QC) emissions. The conversion of low energy photons into a high energy photon is called as upconversion (UC). The downconversion (DC) reveals the conversion of a high energy photon into the low energy photon. On the other hand, the quantum cutting (QC) refers the conversion of a high energy photon into two or more low energy photons. In these processes, the rare earth ions are also involved in the energy transfer, which occurs from the sensitizer to the activator ions. The energy transfer leads to improve the emission intensity of the materials. The energy transfer mechanism has been discussed using energy level diagram and was also verified by the lifetime measurements. The possible applications of these materials have also been discussed.