

# Investigation of $\text{Eu}^{3+}$ Site Occupancy in Cubic $\text{Y}_2\text{O}_3$ and $\text{Lu}_2\text{O}_3$ Nanocrystals

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Z. Naturforsch. **58a**, 551 – 557 (2003); received July 24, 2003

The distribution of luminescent  $\text{Eu}^{3+}$  ions in crystals with the cubic bixbyite-type structure is subject of debate. In this work, the actual occupancy of the two cation sites available for europium in yttria and lutetia nanocrystals with sizes of 10–20 nm has been evaluated by means of  $^{151}\text{Eu}$  Mössbauer spectroscopy. The spectral contribution of the ion at different crystalline sites has been resolved, allowing for the quadrupole splitting. The spectra of the nanocrystalline  $\text{Y}_{1.8}\text{Eu}_{0.2}\text{O}_3$  and  $\text{Lu}_{1.8}\text{Eu}_{0.2}\text{O}_3$  compounds have been analyzed in detail; the  $\text{C}_{3i}$  and  $\text{C}_2$  sites are occupied by the europium ion in a statistical way. The hyperfine parameters have been discussed in terms of symmetry and bonding. An increase of the covalence of the Eu-O bond has been found in the series of compounds  $\text{Gd}_2\text{O}_3$ ,  $\text{Eu}_2\text{O}_3$ ,  $\text{Y}_2\text{O}_3$  and  $\text{Lu}_2\text{O}_3$ .

*Key words:* Europium; Oxides; Nanocrystals; Mössbauer Spectroscopy; Structural Properties.