Mössbauer Investigation of Eu$^{3+}$ Site Occupancy and Eu-O Covalency in Y$_2$O$_3$ and Gd$_2$O$_3$ Nanocrystals

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Z. Naturforsch. 56 a, 267–272 (2001); received November 11, 2000

Samples of nanocrystalline Y$_{1.8}$Eu$_{0.2}$O$_3$ and Gd$_{1.8}$Eu$_{0.2}$O$_3$ were examined by $^{151}$Eu Mössbauer spectroscopy. The degree of covalency of the Eu-O bond has been studied. The spectrum of the cubic Y$_{1.8}$Eu$_{0.2}$O$_3$ sample has been resolved into 2 contributions due to europium in the G$_i$ and C$_2$ sites, for the first time in $^{151}$Eu Mössbauer spectroscopy. The degree of covalency and the electric field gradient of the 2 sites has been compared. The occupancy, by the lanthanide ion, of the more and less symmetric sites in the cubic structure of Y$_{1.8}$Eu$_{0.2}$O$_3$ has been investigated and discussed.

Key words: Europium; Yttrium; Oxides; Nanocrystals; $^{151}$Eu Mössbauer Spectroscopy.