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PROPERTIES OF NON-CRYSTALLINE EuIG AND DyIG OBTAINED FROM MÖSSBAUER AND MAGNETIZATION MEASUREMENTS

F.J. Litterst, J. Tejada and G.M. Kalvius


Abstract - Non-crystalline (nc) EuIG and DyIG have been prepared by dc-sputtering. Mössbauer data on $^{57}$Fe, $^{151}$Eu and $^{161}$Dy reveal sharp magnetic transitions at $T_m = 62$ K and 70 K for nc EuIG and DyIG, respectively. The $^{57}$Fe hyperfine (hf) spectra consist of three superpositioned patterns for $\text{Fe}^{3+}$ in tetrahedral and octahedral and for $\text{Fe}^{2+}$ in tetrahedral oxygen coordination. The saturation hf fields are reduced compared to the values of the corresponding crystalline materials. The induced hf field at $^{151}$Eu is only 1/8 of that for crystalline EuIG. The microchemical composition and structure of the nc materials can be satisfactorily explained by a small oxygen deficiency due to preferential oxygen sputtering. Macroscopic magnetization suggests ferrimagnetic order possibly of sperimagnetic type. Although a part of the deviations of the magnetic hf parameters from the values for the corresponding crystalline substances can be explained by a distribution in the molecular field, the strong reduction of $T_m$ must be attributed to a decrease of the average molecular field due to the distorted superexchange bonds.