

Multiple spin echo formation (abstract)

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Multiple spin echo formation for quadrupole nuclei ($I > 1/2$) in magnetics having inhomogeneous hyperfine and quadrupole interactions was investigated using two and three pulses technique. It was shown that the "forbidden" echo appearance is possible for the time intervals comparable with the characteristic times of the quadrupole and hyperfine broadening. The amplitude drop when the time interval between exciting pulses increases is determined not by relaxation time (as usual) but by inhomogeneity having the larger characteristic time (HFI or quadrupole). Multiple spin echo signal for the two pulses technique is due to the transitions with quantum numbers $m_2 > m_1$.¹ However, when three pulses technique with "unusual" exciting pulses sequence ($\tau_{12} > \tau_{23}$) is used transitions with $m_1 < m_2$ take part in generation of some additional echo signals. This is confirmed by amplitude and time dependences for the echo signals.

¹V. I. Tsifrinovich, *Sov. Phys. JETP* **94**, 208 (1988).

The ⁵⁷Fe Mössbauer spectra of oriented single-crystal and powder PbFe₁₂O₁₉ (abstract)

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The recent determination of the crystal structure of PbFe₁₂O₁₉ by means of single-crystal x-ray diffraction has made it possible to carry out a definitive and comparative analysis of the structure-property relationship of PbFe₁₂O₁₉, SrFe₁₂O₁₉, and BaFe₁₂O₁₉. We have therefore performed ⁵⁷Fe Mössbauer measurements on oriented, single-crystal, and powder samples of PbFe₁₂O₁₉ at 298 K. For a single-crystal oriented parallel to the *c* axis, five distinct patterns are observed. The hyperfine fields, isomer shifts, and quadrupole interactions are as follows: 12k: $H_{\text{eff}} = 413$ kOe; $\delta = 0.33$ mm s⁻¹; $\Delta = 0.35$ mm s⁻¹; $4f_1$: 487 kOe; 0.24 mm s⁻¹; 0.13 mm s⁻¹; $4f_2$: 514 kOe; 0.39 mm s⁻¹; 0.29 mm s⁻¹; 2a: 496 kOe; 0.30 mm s⁻¹; 0.11 mm s⁻¹; 2b: 399 kOe; 0.30 mm s⁻¹; 2.00 mm s⁻¹. The relative magnitude of each of these parameters is in good agreement with and exhibits the same trend observed for high-purity SrFe₁₂O₁₉. The relative intensity of the 2*b* pattern for the crystal oriented parallel to the *c* axis is 8.2%, which approaches its theoretical value; of the total number of iron ions in the structure, 8.33% of them occupy the 2*b* site. The value for the polycrystalline sample is only 5.4% of the total intensity. However, for a single crystal oriented perpendicular to the *c* axis, the 2*b* pattern exhibits a negligible intensity within the experimental error. This result confirms the dynamic disorder in the position of the 2*b* iron ions and suggests a stronger anisotropy for the case of PbFe₁₂O₁₉ than for SrFe₁₂O₁₉ and BaFe₁₂O₁₉. Even though the trend in hyperfine parameters at 298 K is similar to Sr, Ba, and Pb hexaferrites, PbFe₁₂O₁₉ exhibits hyperfine fields that are consistently lower than those of the Ba and Sr analogues. This result is discussed in terms of the Curie temperatures, magnetic exchange interactions, and structural parameters.