Observation of spin modulated magnetic structure at Bi -and Fe-sites in $BiFeO_3$ by nucler magnetic resonance

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9.7 cm

NMR spectra were measured in ^{57}Fe enriched ferroelectric-antiferromagnet $BiFeO_3$ with space modulated magnetic structure of cycloidal type, which has large period λb0$\pm$20Å incommensurate with the lattice parameter. The magnetic moments of the Fe$^{(}$3+) ions, while retaining local antiferromagnetic G-type mutual orientation, are turned in the plane perpendicular to the hexagonal basal plane along the propagation direction of the modulated wave. The wave vector q of such a cycloid is perpendicular to the threefold axis and lies in the plane of spin rotation. This structure leads to space modulation of local field on ^{57}Fe nuclei as well as space periodic spin-spin relaxation and specific NMR line shape with frequency variable local width. Line shape temperature behavior is described using the model of nuclei in Bloch walls. This effect is based on indirect Sule-Nakamura spin-spin interaction which becomes effective at high concentration of magneto-active nuclei as a consequence of excitement of spin waves. Space modulated magnetic structure induces also an appearence of hyperfine magnetic field H_{hf} of 11-12 T at Bi position which has been observed by zero-field ^{209}Bi NMR. Complicated ^{209}Bi spectrum consists of various lines with asymmetric line shape. It was simulated assuming that H_{hf} rotates in space following cycloidal magnetic structure with the same period as at Fe-site and anharmonic parameter 0.95.

13.4 cm

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