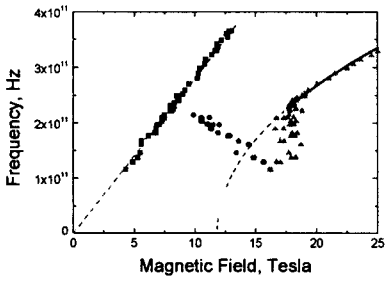
Electron Spin Resonance Measurements of High Magnetic Field Induced Phase Transition in magneto-electric $BiFeO_3$

A. Pyatakov*[1], D. Viehland,[2] B. Ruette[2], S. Zvyagin[3], S. Barilo[4], A. Zvezdin[1]

[1] Institute of General Physics, Russian Academy of Science, 119991, Moscow, Russia
[2] Dept. of Materials Science and Engineering, Virginia Tech, VA 24061, Blacksburg, USA
[3]The National High Magnetic Field Laboratory, FL 32310, Tallahassee, USA
[4]Institute of Solid State Physics and Semiconductors, 220072, Minsk, Byelorussia
*Corresponding author: e-mail: alpya@newmail.ru, Phone: +07 095 9309808, Fax: +07 095 1350270

$BiFeO_3$ is a magneto-electric material, i. e. substance where electric and magnetic orders coexist. Its magnetic structure is locally antiferromagnetic but exhibiting long-range incommensurate modulation with a wavelength of ~ 600 angstroms [1,2]. At magnetic field ~20 Tesla the phase transition from modulated to homogeneous magnetized state occurs [3]. Electron spin resonance (ESR) spectrum observations were conducted at temperature 4.2 K in the field range of 0-25 Tesla, frequency range 100-370 kHz. The data demonstrated many interesting features, including: (i) significant changes in the ESR spectrum at the phase transition field (18 Tesla), (ii) magnetic hysteresis of the ESR spectrum at the phase transition field that appears in dispersion of experimental points in phase transition field region (~18 Tesla). Theoretical explanation of the observed dependences at high field is proposed that take into account anisotropy of the crystal and homogeneous antisymmetrical exchange (Dzyaloshinsky-Moria interaction). The values $6.6 \cdot 10^5$ erg/cm^3 for uniaxial anisotropy constant and $1.2 \cdot 10^5$ Oe for Dzyaloshinskii-Moria constant were obtained from the experimental data.



References

[1] I. Sosnowska, et al, J. Phys. C., Solid State Phys. 15, 4835 (1982)

[2] A. Zalesskii, A. Zvezdin, A. Frolov, and A. Bush, JETP Lett. 71, 465 (2000)

[3] Yu. F. Popov, A. Zvezdin, A. Kadomtseva, et al , JETP Lett. 57, 69 (1993)