EPR Studies of the Weak Ferromagnetism and Ferroelectricity in $K_3Fe_5F_{15}$

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Introduction

$K_3Fe_5F_{15}$ is a multiferroic fluoride.[1] It is ferroelectric and ferroelastic with a Curie temperature T_C=490 K. Here we report on the EPR studies of the weak ferromagnetic transition at T_N=122 K in $K_3Fe_5F_{15}$.

Experimental

Polycrystalline and single crystal $K_3Fe_5F_{15}$ were prepared[2] under dry argon in a sealed gold tube. The X-band (9.4 GHz) EPR spectra as a function of temperature between 4 and 300 K were measured on a Bruker Elexsys 580 spectrometer available at the National High Magnetic Field Laboratory in Tallahassee, FL. The dc magnetic measurements were performed on a Quantum Design SQUID magnetometer over 1.8-300 K.

Results and Discussion

Figure 1 shows a clear anomaly in the dc magnetic susceptibility at T_N=122 K which indicates a weak ferromagnetic transition. Below T_N narrow hystereis loop is seen in the M Vs H data and it disappears above T_N. Temperature dependence of the EPR line width (Fig. 2a) exhibits an increase at around T_N=122 K, confirming a phase transition occurring in $K_3Fe_5F_{15}$.

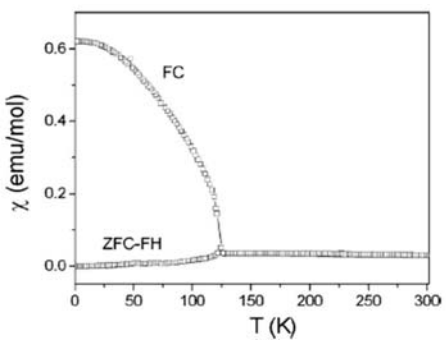

Fig. 1 Temperature dependence of the dc magnetic susceptibility showing a clear anomaly at 122 K in both zero-field-cooled and field-cooled measurements.

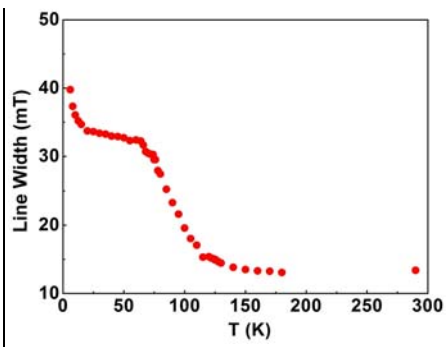

Fig. 2(a) Temperature dependence of the EPR line width with the long $K_3Fe_5F_{15}$ crystal axis oriented parallel to the magnetic field.

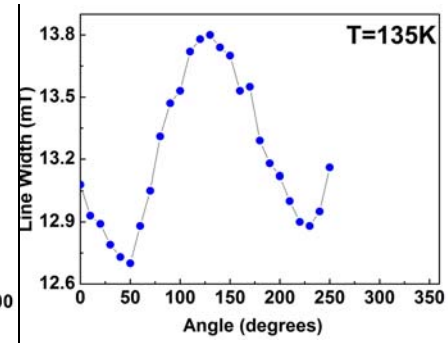

Fig. 2(b) Angular dependence of the EPR line width at T=135 K. A periodicity of 90˚ was found.

Conclusions

$K_3Fe_5F_{15}$ is a multiferroic weakly ferromagnetic magnetoelectric system.

Acknowledgements

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References

[1] Blinc, R., *et al*., J. Appl. Phys. **103**, 074114 (2008).
[2] de Pape, R., Compt. Rend. **260**, 4527 (1965).