Magneto-Electric Effect in Bose Glass Candidate: $NiCl_{1.85}Br_{0.15}$ - $4SC(NH_2)_2$

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Introduction

The introduction of disorder in systems that undergo Bose-Einstein condensation at low temperatures can lead to a new Bose glass state if sufficient disorder is introduced. A leading candidate for this new state is Br-doped dichloro-tetrakis-thiourea-nickel (DTN). This material in the pure state has been shown to undergo BEC near 1 mK [1] and form a Bose glass state for Br dopings of 15% [2].

Experimental

High sensitivity susceptibility measurements were carried to determine the changes induced by applied ac electric fields for a single crystal of Br-doped DTN at very low temperatures. In addition the dielectric susceptibility was followed for changes in the magnetization as a function of applied magnetic field.

Results and Discussion

Remarkable changes were observed for the field dependence of the ac dielectric susceptibility in the vicinity of the upper critical field for long range magnetic ordering in DTN.. These changes are shown in **Figure 1** for temperatures 25<T< 600 mK.

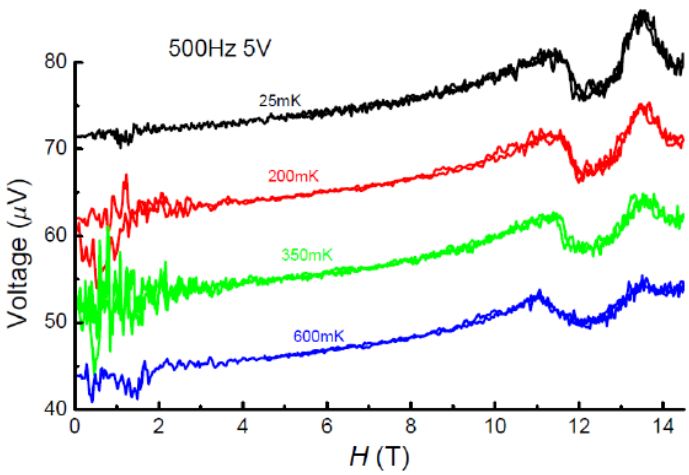

Figure 1. Electric field-induced changes in the magnetic susceptibility of Br-doped DTN at very low temperatures as a function of applied magnetic field. A double peak in the susceptibility is observed at the upper critical field (12.5T).

Conclusions

Application of an ac electric field induces changes in the spin polarization that are accentuated at the upper critical field. These changes are interpreted as resulting from the magneto-elastic interactions in this class of material.

References

[1] Yin, L., Xia, J.S.; Zapf, V.; Sullivan, N.S.; Padhuan-Filho, A; J. Low Temp. Phys. **158**,710 (2010).

[2] Yu, R.; Yin, L.; Sullivan, N.S.; Xia, J,.S.; Huan, C.; Oadhaun-Fliho, A.; Olivera, N.F.; Haas, S.; Steppke, A.; Miclea, C.F.; Weikert, F.; Movshoovich, R.; Mun, E.-D.; Scott, B.L.; Zapf, V.S.; Roscilde, T.; Nature **489**, 379 (2012).