Direct Observation of the Charge Ordering Transition in the Quasi-1D S=1/2 $(TMTTF)_2AsF_6$ Using High Field EPR

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Introduction

Quantum spin chains (S = 1/2, 1D) have attracted great interest for many years due to many non-classical properties (no antiferromagnetic order, quantum phases, spinon dynamics). One-dimensional organic conductors have been studied for many decades because of the rich temperature/pressure phase diagram. Here we studied the charge ordering (CO) transition in $(TMTTF)_2AsF_6$. This transition has been detected using EPR at low field but only exhibit a small increase of the linewidth at the CO transition [1]. The purpose of this study is to resolve the spectrum using high frequencies/fields EPR.

Experimental

Experiments have been performed using the quasi-optical high frequency EPR spectrometer of the EMR Facility operating at 120 GHz, and the 12.5 T SC magnet. A 700x200x100 microns-sized sample was used. Chain axis *a* (the hard anisotropic axis) has been set as the rotation axis. The single crystal has been oriented to be H//b.

Results and Discussion

Above about 105 K only one line is observed. Below 105 K the shape of the line change and the linewidth increases. Below about 80 K the two lines are resolved.

In this system, the CO transition had been measured at about 100 K. This splitting in two lines has been observed in many samples, always at the same temperature and is lightly anisotropic (not shown here).

Conclusions

This study is the first direct observation of the charge ordering effect on the electron spin resonance. It proves that despite the very weak spin-orbit coupling, a multiferroic property exist in (TMTTF)2AsF6, strong enough to be characterized by HF-EPR.

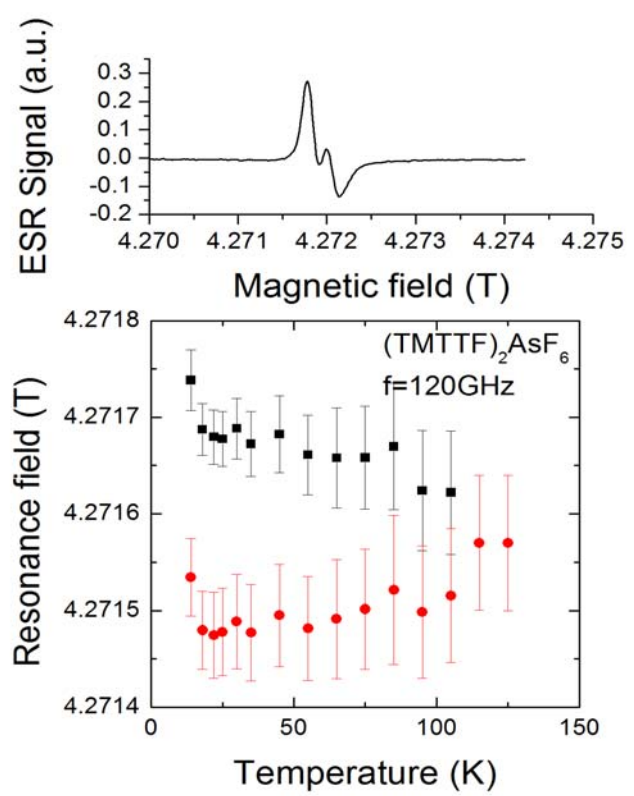

Fig: (top) example of an ESR spectrum recorder at T=15K at 120GHz.(bottom) Temperature evolution of the resonant field of the two lines.

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References

1. Dressel, M., *et al.,* Crystals, **2,** 528–578 (2012).