Field-Induced State in the HMTSF-TCNQ: Search for Quantum Hall Effect

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Introduction

HMTSF-TCNQ is quasi 1D organic conductor which exhibits CDW at p = 0. At the pressure of 1 GPa, where CDW is suppressed, we expect magnetic field-induced phase in magnetic field accompanying a quantum Hall effect (QHE) as seen in field-induced phases (FISDW) in $(TMTSF)_2X$ salts. We are very much interested whether or not a similar effect is seen in a CDW system as in a FICDW.

Experimental

We prepared a rotatable pressure cell with 2 samples for Hall study inside, and two un-rotatable cells with 3 samples for each cell; one cell for R_{zz} and the other for Hall study. We used cell 9 with a ^{3}He cryostat and 31 Tesla field. For Hall study, two contacts are placed on both sides of the plate-like sample perpendicular to the x-(1D) axis, along which current is applied. With this terminal configuration, we can derive R_{xy} by subtracting the data of positive and negative field directions and R_{xx} by averaging those.

Results and Discussion

Figures 1 and 2 show R_{xy} in field along z-axis for different samples. It is obvious that overall behavior looks similar. However, flat region in sample 4 (Fig. 1) is well below zero, whereas the flat region in sample 1 (Fig. 2) is located almost zero in R_{xy}. This fact suggests that the mechanism that determines the overall behavior is different from that which determines the vertical location in R_{xy} sometimes neglecting the polarity of R_{xy} as in Fig. 2.

Figure 2 shows the non-linear Hall signal, which is prominent above 12 T. Figure 3 shows the field dependence of R_{xx}, derivation of which is described above. In the region between 0.2 T and 12 T the flat nature of the Hall signal (R_{xy}) and nearly zero magnetoresistance (R_{xx}) strongly suggests quantum Hall effect behavior. Further details, prior to the present Hall effect data, are described in a recently accepted paper [1].

Acknowledgements

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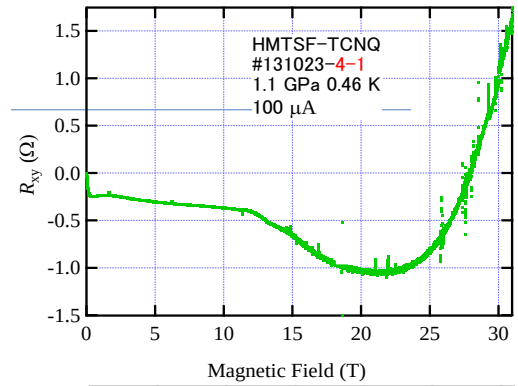
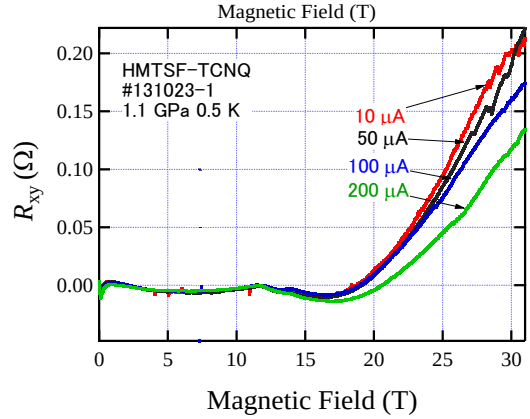
References

[1] Murata, K., *et al*., to be published in the special issue "New Trends of Fermiology", **40**, (2014) of "Low Temperature Physics" dedicated to the 60th anniversary of Lifshitz – Kosevich theory.





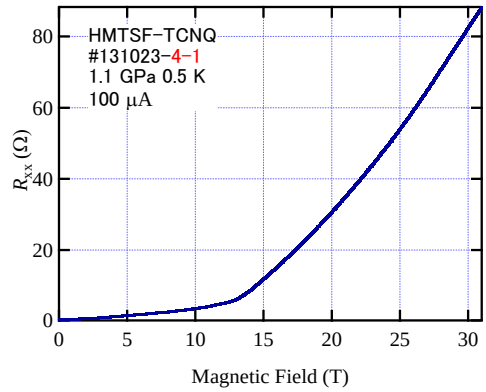


Fig. 1(top) Field dependence of R_{xy} for sample #4 at about 0.5 K under pressure of1.1 GPa.

Fig. 2(middle) Current dependence of R_{xy} for sample #1 in the same conditions as Fig. 1.

Fig. 3(bottom) R_{xx} for sample #4 in the same conditions as Fig. 1.