Unidirectional Tetramer Formed in Molecule-Based Superconductor

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Our previous study on the candidate of the molecule-based spin-liquid revealed the electron pair in the transiently formed tetramer [1]. In this symposium, we report the similar fluctuation in the molecule-based superconductor [2,3].

Figure 1 shows the Raman spectra below the superconducting transition temperature of β''^{-} $(ET)_2Ga(C_2O_4)_3(H_3O)C_6H_5NO_2$. The behavior of the lattice-sensitive vibrational modes (Y1, Y2, Y3 and Y4) indicated that the unidirectional tetramers were transiently formed in part of the conducting layer. The behavior of the charge-sensitive vibrational modes (R, P and B) revealed that molecular charges in both tetramer (R and P) and non-tetramerized molecules (B) were inhomogeneous. Two cationic and two neutral molecules constitute the transiently formed tetramer. Charges in non-tetramerized molecules are more delocalized than the pair of holes in the transiently formed tetramer.

We applied the uniaxial pressure in the crystallographic *b*-direction which is almost parallel to the unidirectional tetramer. Figure 2 shows the temperature dependences of the electrical resistivity. Not only the superconducting transition temperature but also the electrical resistivity and activation energy just above the transition temperature were drastically enhanced. The change from the metallic temperature dependence to the insulating temperature dependence indicates that the area of non-tetramerized molecules decreases and the area of the transiently formed tetramer increases. This result also indicates that the superconductivity originates from the pair of holes in the transiently formed tetramer.

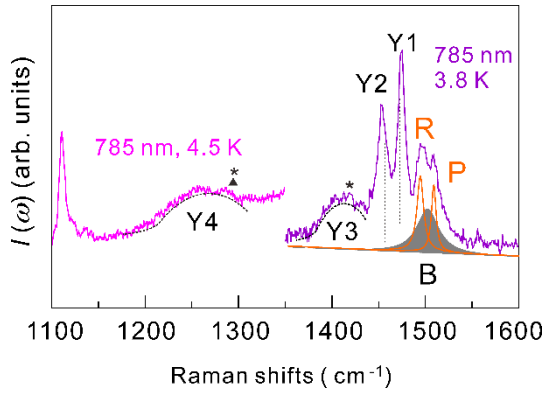

Fig. 1. Raman spectra.

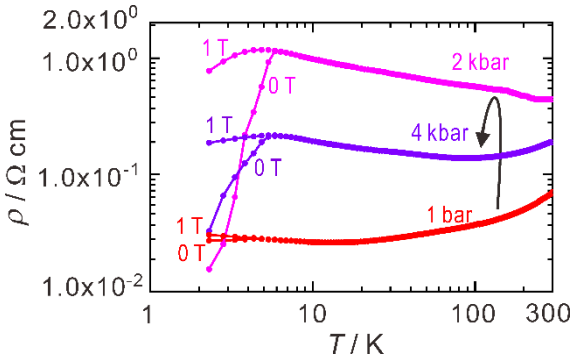

Fig. 2 Electrical resistivity under the uniaxial (2 and 4 kbar) and ambient pressures (1bar).

References

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