



Contribution ID: 49

Type: not specified

## The low temperature electronic state of an organic superconductor $\beta''$ -(BEDT-TTF)<sub>4</sub>[(H<sub>3</sub>O)Ga(C<sub>2</sub>O<sub>4</sub>)<sub>3</sub>]PhNO<sub>2</sub> with strong charge fluctuations

Tuesday, July 7, 2015 8:30 PM (1h 30m)

Unconventional superconductivity has been a challenging subject to study in condensed matter science. The pairing of electrons in conventional superconductors can be explained by a weak attractive force by means of the electron-phonon coupling known as the BCS mechanism. However the mechanisms of many unconventional superconductors are still open questions. In this study, we investigated an organic superconductive salt  $\beta''$ -(BEDT-TTF)<sub>4</sub>[(H<sub>3</sub>O)Ga(C<sub>2</sub>O<sub>4</sub>)<sub>3</sub>]PhNO<sub>2</sub>, which is considered a candidate of unconventional superconductors. This salt is 1/4 filling salt and should be metal from the viewpoint of the band filling. However the effective inter-site Coulomb repulsion  $V$  works to make CO state because of strong electron correlation. In the electronic phase diagram of  $\beta''$ -type salts, the superconductive phase is located between the charge ordered (CO) phase and normal metallic (M) phase. The superconductivity is considered to relate to the degree of freedom of charge.

In this study, we measured temperature and magnetic field dependence of heat capacity of this salt by single crystal samples for elucidation of the relationship between superconductivity and the charge disproportionation.

As a result, we detected three thermodynamic anomalies in the temperature range of 7 K - 12 K. The highest temperature anomaly is CO anomaly since it does not show any magnetic field dependence. The other two are probably related to superconductivity. Below 2 K, temperature dependence of the heat capacity can be well fitted by an equation  $\beta T^3 + \gamma T - b T \ln(T) + a T^2$ . The contribution of electronic heat capacity gives complicated behaviour including glassy terms and fluctuation terms. These unique features indicate that this  $\beta''$  type superconductor have possibilities of charge fluctuation mediated superconductivity.

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**Session Classification:** Posters

**Track Classification:** molecular magnets and nanomagnets