

Structural properties of the incommensurate organic superconductor (MDT-TS)(AuI₂)_{0.441}

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Introduction

In organic superconductors, the ratios of the donor molecules to anions are represented by an integer (typically 2:1) [1]. By contrast, the MDT-TSF (methylenedithio-tetraselenafulvalene) series salts are incommensurate ambient pressure organic superconductors and the charge transfer degrees deviate from 0.5 [2]. (MDT-TS)(AuI₂)_{0.441}, where MDT-TS is 5*H*-2-(1,3-diselenol-2-ylidene)-1,3,4,6-tetrathiapentalene, shows a metal-insulator (M-I) transition at $T_{MI} = 50$ K despite of the basically same crystal structure as those of the MDT-TSF superconductors [3]. The ground state of this salt changes from an incommensurate antiferromagnetic insulating state with $T_N = 50$ K to a superconducting phase at 3.2 K under 1.05 GPa [3]. We have observed an incommensurate structural modulation in the donor lattice with $q = 0.114a^*$ [4]. The present paper reports the temperature dependence of the structural modulation of (MDT-TS)(AuI₂)_{0.441}.

Results and Discussion

Figure 1 shows the synchrotron radiation x-ray oscillation photograph at 290 K. This photograph clearly displays incommensurate layer lines. We distinguish the donor lattice and the anion lattice by indices h and h' , respectively. There are clear satellite spots at $h \pm \xi$.

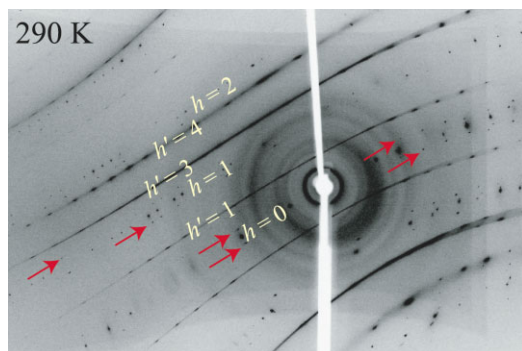


FIG. 1. X-ray oscillation photograph at 290 K.

Figure 2 shows the temperature dependence of ξ estimated from the x-ray oscillation photographs. Although ξ is independent from the temperature below room temperature, ξ shows a step like increase below 50 K. This means that the modulation period slightly changes at the M-I transition. However, the average structure without the modulation does not change.

In summary, we have found the incommensurate structural modulation period changes at the M-I transition temperature. The relationship between the modulation structure and the antiferromagnetic ordering is not clear.

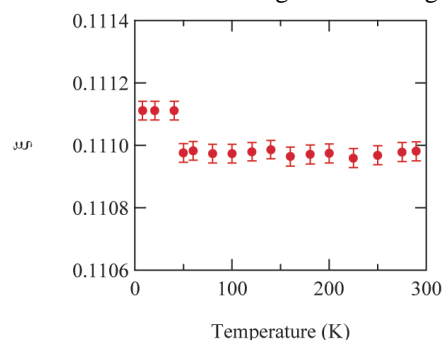


Figure 2 Temperature dependence of the wave number of satellite spots.

References

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