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Structural properties of the incommensurate organic conductor (MDT-TS)$(I_3)_{0.407}$

Tadashi KAWAMOTO*[1], Hisataka Endo[1], Yoshimasa BANDO[1], Takehiko MORI[2], Toru KAKIUCHI[3], Hiroshi SAWA[3,4], Kazuo TAKIMIYA[5] and Tetsuo OTSUBO[5]

[1]Department of Organic and Polymeric Materials, Graduate School of Science and Engineering, Tokyo Institute of Technology, O-okayama, Meguro-ku, Tokyo 152-8552, Japan

[2]Department of Chemistry and Materials Science, Graduate School of Science and Engineering, Tokyo Institute of Technology, O-okayama, Meguro-ku, Tokyo 152-8552, Japan

[3]Department of Materials Structure Science, The Graduate University of Advanced Studies, Tsukuba, Ibaraki 305-0801, Japan

[4]Institute of Materials Structure Science, High Energy of Accelerator Research Organization, Tsukuba, Ibaraki 305-0801, Japan

[5]Department of Applied Chemistry, Graduate School of Engineering, Hiroshima University, Kagamiyama, Higashi-Hiroshima, Hiroshima 739-8527, Japan

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]. Moreover, (MDT-TSF)$(AuI_2)_{0.436}$ has shown the characteristic Fermi surface reconstruction by an incommensurate anion potential [3]. (MDT-TS)$(AuI_2)_{0.441}$, 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 in spite of the basically same crystal structure as those of the MDT-TSF superconductors [4]. 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 10.5 kbar [4]. The I_3 salt of MDT-TS also has an incommensurate structure, and the charge transfer degree of the I_3 salt, 0.407, is smaller than that of the AuI_2 salt (0.441). The I_3 salt shows an M-I transition at 75 K. The present paper reports structural properties of (MDT-TS)$(I_3)_{0.407}$.

Results and Discussion

Although the synchrotron radiation x-ray oscillation photograph clearly displays incommensurate layer lines, the photograph does not show clear I_3^- periodicity. The low-temperature structure is basically the same as that at room temperature. We did not find any extra spot in the donor lattice at 9 K; this means that the space group of the I_3 salt in the insulating phase is the same as that in the metallic phase (*Pnma*). Figure 1 shows the temperature dependence of the lattice parameters. All lattice parameters smoothly increase as the temperature increases.

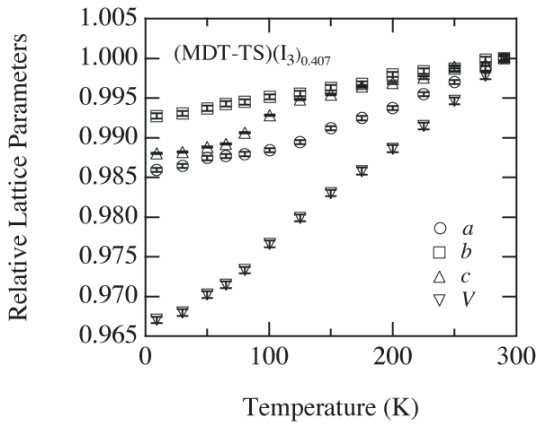

Figure 1 Temperature dependence of the donor lattice parameters of (MDT-TS)$(I_3)_{0.407}$ normalized at room temperature.

In summary, the low-temperature structure below T_{MI} is basically the same as that in the room temperature. We did not find any structural change.

References

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* kawamoto@o.cc.titech.ac.jp