

Photoinduced insulator to metal transition in (BEDT-TTF)₃(ClO₄)₂ and related materials,

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Photoinduced phase transition (PIPT) has recently attracted great interest. Organic conductors are candidate materials for PIPT because they show various phases and their physical properties drastically change by external stimuli. For example, ultrafast photoinduced insulator to metal transition in (BEDT-TTF)-based salts [1] [2] and (EDO-TTF)₂PF₆ [3] with 1/4-filled hole band have been reported. In α -(BEDT-TTF)₂I₃, persistent photoinduced insulator to metal transition with assisted electric field has also been observed [1].

In this study, we have achieved photoinduced insulator to metal transition in (BEDT-TTF)₃(ClO₄)₂, wherein, two holes are accommodated in three BEDT-TTF sites. It shows charge ordered state below 170 K [4]. Figure shows time evolution of photocurrent under pulsed electric field (1000 V/cm, $E//a$) at 4 K. A pulsed laser (repetition rate: 10 Hz, pulse width: 5 ns, wavelength: 450 nm, power density: 17 mJ/cm², unpolarized light) was used for excitation. The large photocurrent with two components is observed. The sample resistance drops more than three orders of magnitude for the first component, which has a lifetime of about 100 ns. After about 1 μ s, the second component started to grow and remained while electric field is applied. Notably, the resistivity for the first component was estimated less than 0.6 Ω cm, which value is comparable to that for the metallic state at high temperature.

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[3] M. Chollet *et al.*, Science 307 (2005) 86.

[4] T. Yamamoto *et al.*, Phys. Rev. B 73 (2006) 125116.

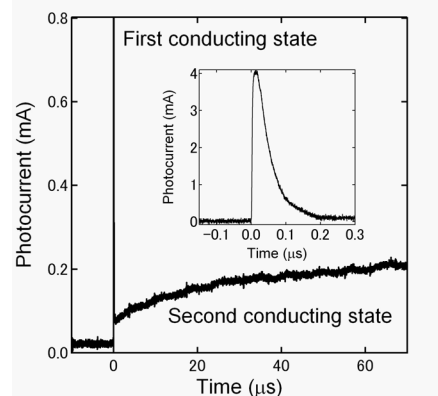


Figure: Time evolution of photocurrent for (BEDT-TTF)₃(ClO₄)₂ at 4 K.