Photoinduced phenomena in $\beta^{\prime\prime}$–(BEDT-TTF)(TCNQ)

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ABSTRACT

Organic charge transfer (CT) complexes containing BEDT-TTF molecule have been attracting many researchers since some of them show interesting physical properties including superconductivity, and intensive studies have been made from both experimental and theoretical points of view. Until today, main part of these studies have been devoted for experiments under equilibrium condition, however, lately, a non-equilibrium state of CT complexes containing BEDT-TTF molecule achieved by light irradiation is becoming a target of extensive studies. Indeed, Iwai has reported ultrafast photoinduced charge order (CO) to metal transition in $\alpha$–(BEDT-TTF)$_2$I$_3$.[1]

Recently, single crystal of $\beta^{\prime\prime}$–(BEDT-TTF)(TCNQ) was synthesized.[2] In this crystal, BEDT-TTF layer shows CO at room temperature and ambient pressure. With lowering temperature, the CO disappeares at about 170K and a metallic state appears gradually. Similar phase transition is also caused by an application of external pressure (about 2 kbar).[3] These results indicate that the electronic state of this compound is located on the verge of the phase boundary.

Considering these results, we started time resolved spectroscopic studies of $\beta^{\prime\prime}$–(BEDT-TTF)(TCNQ) at room temperature. We observed ultrafast reflectivity change using fs laser system with 120fs pulse width (Figure 1). We also observed temperature dependence of the signal, and relaxation time has increased as the sample is cooled down. Estimated critical temperature based on the relaxation time of photo-response is largely different from that of Charge Ordering. At the conference, the detailed discussion will be made.

REFERENCE


Figure 1. Time dependence of photoinduced $\Delta R/R$ at RT.