

Ultrafast Photoinduced Phase Transitions in $(\text{EDO-TTF})_2\text{PF}_6$ with Strong Electron-Phonon Interaction

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The quasi-one-dimensional conducting charge transfer complex $(\text{EDO-TTF})_2\text{PF}_6$ exhibits unique and diverse photo-induced phase transitions probably due to strong electron-phonon interaction. We have revealed these processes step by step by various ultrafast spectroscopic techniques on the femtosecond to nanosecond time scale (Fig. 1) [1-4]. In thermal equilibrium, this complex undergoes phase transition between metal and insulator at 280 K [5]. At low temperatures, the complex is in the insulator phase with charge order (0110), which expresses charge distribution at each EDO-TTF molecule, while at high temperatures, the charge order melts and becomes (0.5, 0.5, 0.5, 0.5). Upon photo-excitation in the low temperature phase, the charge order turns into the photo-induced non-equilibrium (1010)* phase accompanied with phonon oscillations. After approx. 100 ps, this phase undergoes phase transition again and becomes the phase that is close to high temperature metallic phase. The (1010)* phase is also changed into another type of metallic phase under strong excitation within one picosecond, and it reverts to the photoinduced (1010)* phase. This efficiency becomes higher by double-pulse excitation. The property in the high temperature phase is also modified under excitation of intra-molecular band with an ultraviolet pulse.

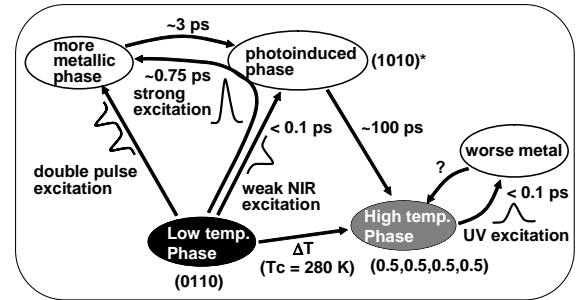


Fig. 1. Overview of the ultrafast photo-induced phase transitions in $(\text{EDO-TTF})_2\text{PF}_6$.

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