

Ultra-fast photoinduced gigantic metallization in quarter filled organic A_2B salts: $(EDO-TTF)_2PF_6$

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We report that the organic metal $(EDO-TTF)_2PF_6$ having 3/4-filled-band (1/4-filled in terms of holes) with strong electron and lattice correlation, shows a highly sensitive response to photoexcitation. An ultrafast, photoinduced phase transition (PIPT) from the insulator phase to the metal phase can be induced with very weak excitation intensity even at near room temperature (270K). The time-resolved spectroscopy with 100fs resolution indicates that the PIPT occurs within 2 ps with the vibratile structure in the time profile of the reflection spectra, of which periodicity corresponds to a Raman scattering frequency of this material (figure 1). As a result, it is concluded that the PIPT process is caused by the cooperative melting of charge ordering assisted by coherent phonon generation¹. 1/4 filled materials that show M-I transition accompanied with the charge ordering can be classified as fascinating candidates for photo-induced cooperative phenomena and application in phase switching devices. X-ray structural analysis using time-resolved crystallography technique will be necessary to clarify the mechanism of this gigantic photoinduced photoresponse.

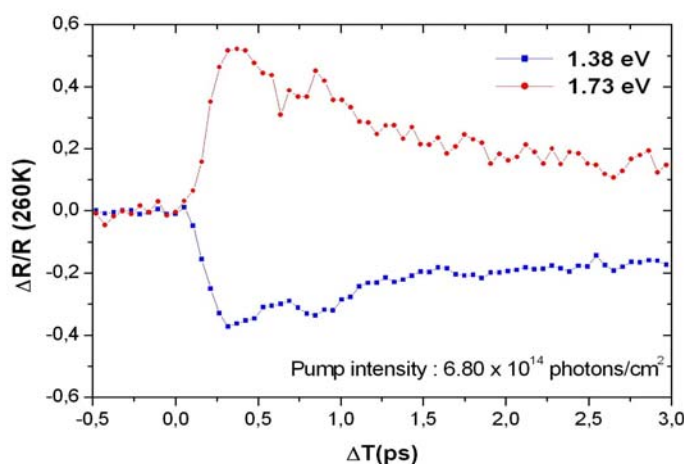


figure 1 : Probe photon energy dependence of the time profile for the $\Delta R/R$ observed at 260 K for a probe photon energy of 1.38eV (blue) and 1.73eV (red). A vibratile structure due to a coherent phonon generation is observed.

¹ M. Chollet, L. Guérin, N. Uchida, S. Fukaya, H. Shimoda, T. Ishikawa, K. Matsuda, T. Hasegawa, A. Ota, H. Yamochi, G. Saito, R. Tazaki, S. Adachi, S. Koshihara, “Gigantic Photoresponse in 1/4-filled-band organic salt $(EDOTTF)_2PF_6$ ”, *Science*, **2005**,307, 86-89