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Femtosecond optical study of chemically induced polaron states in polythiophene films HIDEO KISHIDA, TAKAKI FUJII, TOMOYA UCHIDA, TAKESHI KOYAMA, ARAO NAKAMURA, Department of Applied Physics, Nagoya University — We performed femtosecond pump-probe measurements in poly(3-hexylthiophenes) (P3HT) doped with ionic liquid (OMIM/BF_4). We fabricated an electrochemical cell with glass/ITO/P3HT (regioregular oriented film)/ionic liquid/ITO/glass structure. By applying the voltage between the electrodes, we electrochemically control the doping level. By increase of the applied voltage, the two polarized absorption peaks due to polaron states appear within the optical gap. The dynamics of the photoexcited states were studied by two-color femtosecond pump-probe measurements, in which the photon energies of the pump and probe pulses correspond to the π-π^* transition and the polaron absorption band, respectively. At lower voltage, the increase of the near infrared absorption is observed, which is assigned to the photoinduced polaron absorption. On the other hand, at higher voltage, photoinduced bleaching is observed. The increase of the applied voltage reduces the lifetime of the excited states. These facts suggest that the photoexcitation in the chemically induced polaron states changes the electronic states and induces the new photoexcited species. The detailed origins of the new states are discussed by comparison with the femtosecond pump-probe spectra in PEDOT/PSS.

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