

有機半導体関連セミナー

講師：Prof. Antoine Kahn (Princeton University, USA)

題目：Impact of Doping-Induced Trap Filling on Charge Carrier Mobility and Device Performance

日時：2013年1月23日（水）午後2時50分から

場所：第3エリア 3F800

要旨：This talk focuses on the compensation via doping of electronic state tailing in the gap of organic semiconductors. Gap states act as carrier traps, and have a significant impact on the electrical and electronic properties of thin films and on the performance of devices. We show the controlled passivation of acceptor tail states in fullerene C60 by the addition of a small number of electrons introduced by molecular n-doping. By extending doping to unprecedented ultra-low concentrations (molar ratio = 2×10^{-4}), we demonstrate the controlled progressive filling of the traps with charges released by the dopants, and examine the resulting changes in Fermi level position, conductivity, activation energy and mobility in the electron hopping process in C60 films [1]. A clear transition in carrier transport is found when the dopant concentration reaches the trap density ($\sim 9 \times 10^{18} \text{ cm}^{-3}$), and most traps are filled. The compensation of the traps leads to an increase in the effective electron mobility in C60 by more than three orders-of-magnitude, reaching $0.21 \text{ cm}^2/\text{V}\cdot\text{s}$. Numerical simulations utilizing kinetic Monte Carlo method confirm an exponential tail of trap states. An investigation of ultra-low doped OFETs shows the expected increase in electron mobility and decrease in threshold voltage [2].

[1] S. Olthof et al., Phys. Rev. Lett. 109, 176601 (2012)

[2] S. Olthof et al., Appl. Phys. Lett. 101, 253303 (2012)

世話人：櫻井岳暁