Mid-IR Intraband Cascade EL in Organic Semiconductors

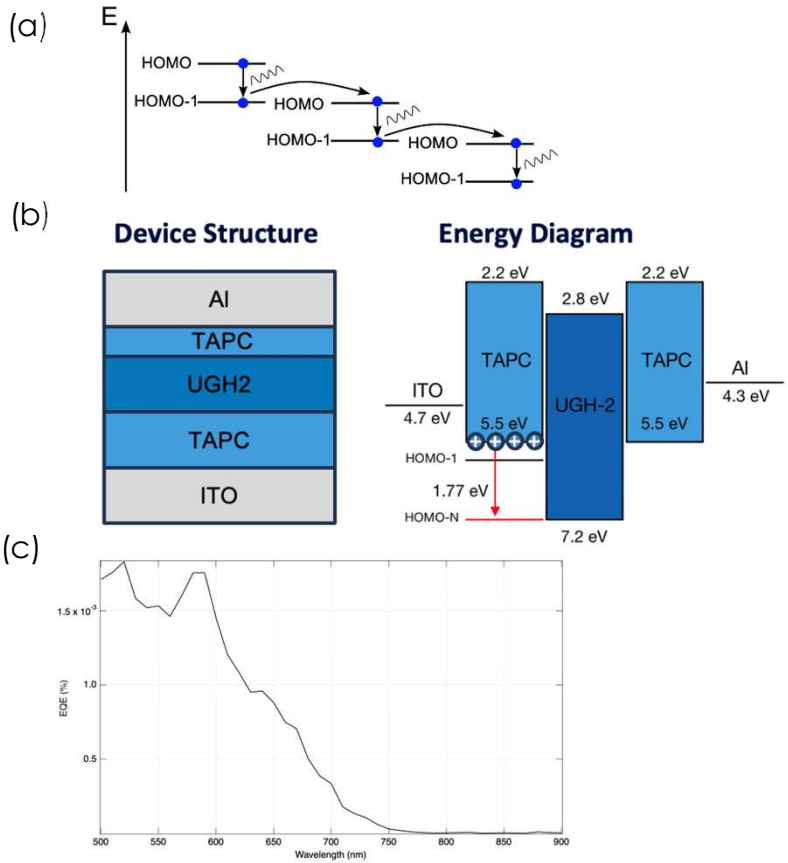

Figure: (a) Intraband cascade in an organic semiconductor (b) Device structure and energy diagram for hot hole extraction (c) Measured EQE spectrum at 9V bias with illumination wavelength from 500 nm to 900 nm.

Objective

- Demonstrate EL/PL in the mid-infrared spectral range using organic semiconductors
- Demonstrate hot hole extraction in an organic semiconductor heterostructure.

Impact

Mid-IR light is important for sensing, diagnostics, and environmental monitoring. However, emission in organics is limited to visible wavelengths by the energy gap law. Our work is focused on engineering a stable and efficient mid-IR source. The cascade process through HOMO to HOMO-1 transition in TAPC provides a potential path for efficient Mid-IR OLEDs. We first demonstrate the hot hole extraction in organic semiconductor heterojunctions through photoexciting accumulated holes at the TAPC/UGH-2 interface from the HOMO to HOMO-N energy levels. External quantum efficiency enhancement at 700nm is observed due to the contribution of photoexcited holes, providing a step towards intraband cascade EL in organic semiconductors.

Facilities and Methods Used

- Angstrom thermal evaporator
- EQE testing setup

Relevant Papers

- C.-Y. Cheng et al., Phys. Rev. Lett., DOI: 10.1103/PhysRevLett.120.017402
- X. Shen et al., J. Chem. Phys., DOI: 10.1063/5.0225746

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