New device architectures and performance limitations of organic infrared sensors

Organic photodetectors (OPDs) with a performance comparable to that of conventional inorganic ones have been demonstrated for the visible regime. However, infrared (IR) photodetection has proven to be challenging and, to date, the true potential of organic semiconductors in the near-infrared spectral range (800–2500 nm) and beyond remains largely unexplored. In this talk, I will introduce new device concepts for organic IR detectors, based on resonant optical cavities and doped photo-active layers. Design rules and optimization strategies will be discussed, yielding broadband, as well as wavelength selective devices with a tunability of the detection wavelength over several hundreds of nanometers, allowing the printing of miniature NIR spectrometers. In a second part of the talk, we explore the performance limitations of organic IR detectors: A relation between open-circuit voltage, dark current, and noise current is demonstrated for OPDs with detection wavelengths beyond 1100 nm. Based on these findings we estimate an upper limit of achievable specific detectivity values for organic photodiodes as a function of their longest detection wavelength and discuss the potential of organic semiconductors in thermal detectors.

Zoom: https://syddanskuni.zoom.us/j/61727253499