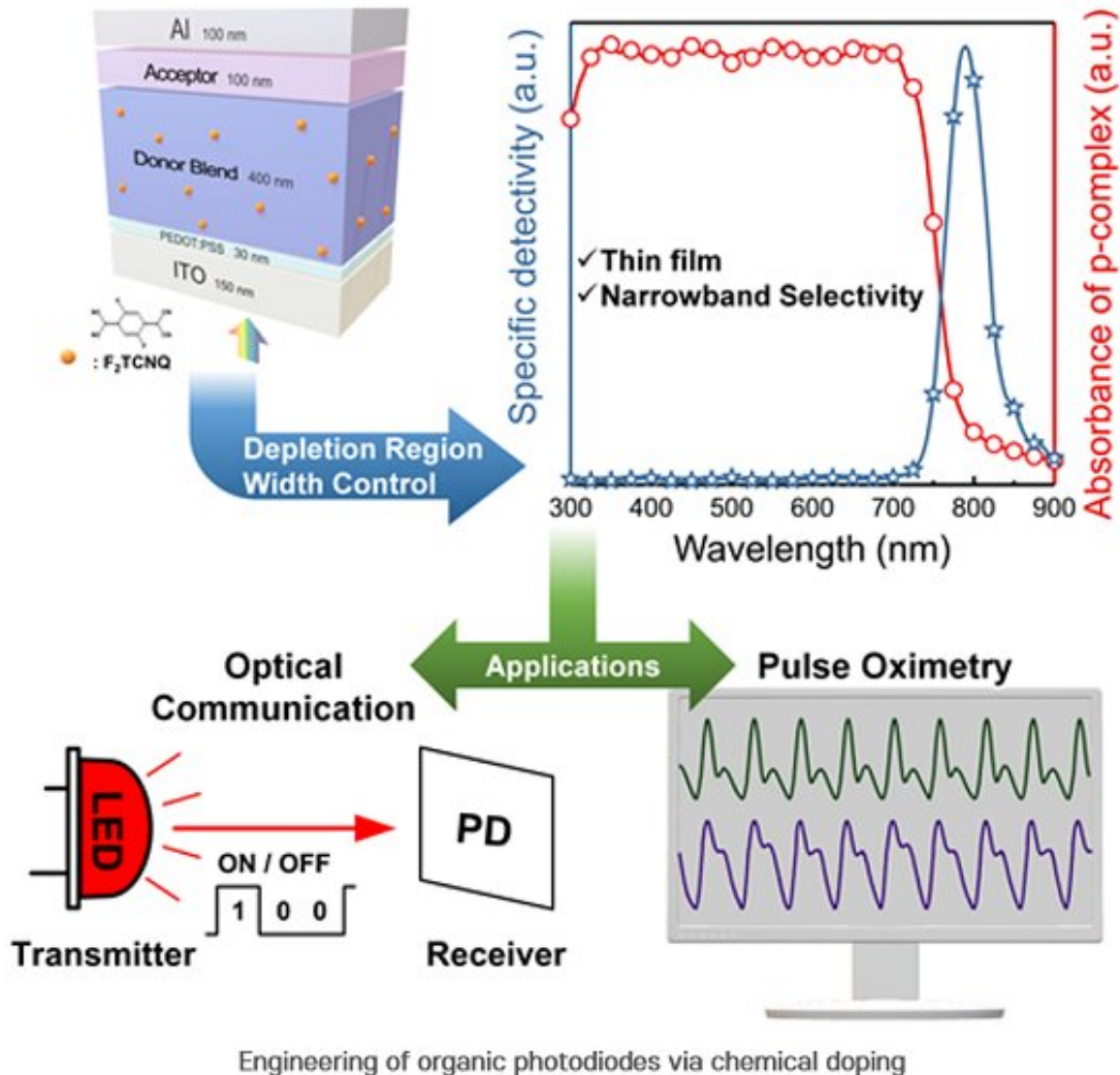


OPD optical sensors that reproduce any color

October 21 2020



Engineering of organic photodiodes via chemical doping

Credit: Pohang University of Science & Technology (POSTECH)

Photodiodes are optical sensors that convert the energy of light into electrical energy. Organic photodiodes (OPDs) respond quickly and have the advantage of being able to realize colors free from color filters because they can control the spectral response of wavelengths. However, most of the color controlling methods reported so far do not fit the current trends of small, thin screens because they thicken the photodiodes to cause light distortion. To meet such demands, a POSTECH research team has succeeded in producing thin-film organic photodiodes with accurate and simple junction engineering.

A research team led by Professor Dae Sung Chung and Ph.D. candidate Mingyun Kang of POSTECH's Department of Chemical Engineering has demonstrated an accurate and convenient junction engineering of organic photodiodes (OPDs) via chemical doping. The research findings were recently published in *Materials Horizons*, an international journal published by the Royal Society of Chemistry (RSC).

Photodiodes are the result of adding a photo-detection function to the PN junction of a semiconductor, and when light is incident to the diode, it creates an exciton and dissociates into an electron and a hole, which conducts electricity. The current increases as the light becomes stronger.

The research team succeeded in producing thin-film OPDs with color selectivity by controlling only the depletion region width (DW) rather than the overall thickness of the active layer. By doping the organic materials—which has strong electron withdrawing property—to semiconductors, it allows the optical charges to be separated in a precise way.

Organic photodiodes are replacing silicon photodiodes because they are thin and can control the spectral response of wavelength range. However, there has never been a case where the [wavelength range](#) was adjusted while maintaining the thinness of photodiodes. This study is the first

case that confirmed that photodiodes' spectral response of wavelength can be freely refined, significant for producing thin-film color-filter-free optical sensors.

"By developing photodiodes that only respond to certain wavelengths using chemical doping, we have produced optical sensors that fundamentally inhibit signal generation due to unwanted wavelengths," elaborated Professor Dae Sung Chung who led the study. He added, "Unlike the existing strategies of detecting light in narrowband, we can freely control the [wavelength](#) of [light](#)."

More information: Mingyun Kang et al, Spectral refining of organic photodiodes via chemical doping: from analyses to applications, *Materials Horizons* (2020). [DOI: 10.1039/D0MH01234C](https://doi.org/10.1039/D0MH01234C)

Provided by Pohang University of Science & Technology (POSTECH)

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