the design and the careful choice of host material that combats unwanted non-radiative relaxation. The big challenge now is to reduce the cost of manufacturing through the use of low-cost electrodes materials, thin-film encapsulation and roll-to-roll manufacturing.

Light-emitting sensors
Ad: DOI:10.1038/ncomms20000
In addition to emitting light, OLEDs can also be used to construct small and convenient gas sensors. This is the finding reported by Stefan L. and co-workers from Austria who have demonstrated that organic semiconductors can help the sensing of an analyte. The team constructed a device with a similar structure to a polymer-based OLED, except that an analyte-sensitive dye molecule was added to the OLED's electro-active layer. The researchers observed a decrease in emission intensity when the device was exposed to oxygen. They confirmed that the luminescence decrease does not relate to the degradation of the device during operation but is instead attributed to the quenching of the excited dye molecules in the electro-active region as a result of oxygen diffusion. Because a wide variety of dye molecules can be used for this setup, the researchers anticipate its use beyond oxygen detection.

Photonic crystals boost efficiency
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Polyethylene terephthalate (PET) poly[(3,5-dimethyl-2,2'-bithiophene)] and [6,6]-phenyl-C61-butyric acid methyl ester (PCBM) were used as the bulk-heterojunction layer. The photonic crystal structure was composed of highly ordered arrays of columnar features with a diameter of 110 nm and a periodicity of 400 nm. It was fabricated in the layer using pattern replication in non-wetting templates (PRINT) in a single process over an area of 4 cm². The team obtained a 10-fold absorption enhancement near the band edge of the bulk-heterojunction layer and an efficiency improvement of 70%. They attributed these results to improved absorption and electrical enhancements due to the photonic geometry. Owing to the multiple resonances in the photonic crystal structure, this approach allows selection of desired regions of the solar spectrum for absorption enhancement.

Surface plasmon enhancement
Surface plasmon-enhanced absorption and emission of mid-infrared inorganic semiconductor nanocrystals in the electro-active region as a result of oxygen diffusion. Because a wide variety of dye molecules can be used for this setup, the researchers anticipate its use beyond oxygen detection.

Photonic crystals were investigated in the aim of improving organic solar cell efficiency. New benefits have been seen experimentally by a group of researchers from the University of North Carolina at Chapel Hill, USA. Doo-Hyun Ko and colleagues imprinted a two-dimensional photonic crystal into the photoactive bulk-heterojunction layer of organic solar cells. As a proof of concept, a blend of thermally-depositable polyethylene terephthalate (PET) poly[(3,5-dimethyl-2,2'-bithiophene)] and [6,6]-phenyl-C61-butyric acid methyl ester (PCBM) were used as the bulk-heterojunction layer. The photonic crystal structure was composed of highly ordered arrays of columnar features with a diameter of 110 nm and a periodicity of 400 nm. It was fabricated in the layer using pattern replication in non-wetting templates (PRINT) in a single process over an area of 4 cm². The team obtained a 10-fold absorption enhancement near the band edge of the bulk-heterojunction layer and an efficiency improvement of 70%. They attributed these results to improved absorption and electrical enhancements due to the photonic geometry. Owing to the multiple resonances in the photonic crystal structure, this approach allows selection of desired regions of the solar spectrum for absorption enhancement.

Magnetic field improves OLED intensity
Although the output emission intensity of an OLED often decreases gradually over time, researchers in Japan have discovered that in fact the opposite occurs — intensity actually increases if a magnetic field is applied to the device. Hiroshi Okumura and co-workers from RIKEN, Tokyo Institute of Technology and Suntory Chemical, applied an external magnetic field of up to 800 mT to OLEDs made from a luminescent layer based on poly(1,4-phenylenevinylene) (PPV). They observed that at a field strength of 200 mT, the emission intensity was 1.4-1.5 times higher than with no applied field. They also observed that the emission intensity increased over time, reaching a maximum after approximately 20 h. The increase in emission intensity is attributed to the promotion of long-range charge recombination, induced by a structural change in the OLED material.