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Towards an All-Organic Oxygen Sensor

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Organic electronics devices, such as light-emitting diodes (OLEDs) and photodetectors (OPDs) are cheap, easy-to-fabricate and very versatile. For these reasons, it is advantageous to use them for sensor applications. For instance in case of oxygen (O2), which is the most abundant element on earth, there is a big need for cheap sensors. Especially industry and biological research require cheap trace oxygen sensors. Optical O2 sensors represent a promising type, since they offer fast response and no O2 consumption. However, they suffer from photodegradation and a rather complex assembly. To overcome these drawbacks, organic electronics with their excellent adjustability can be used to realize a monolithic and therefore cheap implementation.

In this work, we developed a monolithic all-organic oxygen sensor which is composed of a biluminescent sensing layer, an ultraviolet OLED with a peak wavelength of 375 nm as an excitation source and a novel narrow bandwidth OPD. The biluminescent sensing layer shows fluorescence and phosphorescence at the same time which enables self referencing to avoid photodegradation caused distortion. Furthermore, the long lifetime phosphorescence allows sensing within the ultra-trace oxygen range.

Initially, the concept behind the O2 sensor is presented, followed by a detailed discussion on the development of the individual parts. Finally, the steps towards the integration of the O2 sensor are shown, as well as some early characterization results.

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