Abstract

Light detection is used in many applications for example in imaging and sensing technologies. Today, traditional photodetectors are made from rigid, brittle inorganic materials which can limit applications. Organic semiconductors (OSCs), on the other hand, offer advantages like low-cost production, mechanical flexibility, and compatibility with biological systems, which makes them better suited for future medical and biological applications.

In this study, the focus is on enhancing the performance of a specific type of light sensor called a phototransistor, which exploits its ability to tune the conductance of the active region of the device to enhance the sensor signal. The investigated phototransistors are structures that combine OSCs with graphene—materials that are known for their excellent light harvesting and electrical properties, respectively. By tweaking the microscopic structure of the OSC films by using different methods for the deposition of the film or altering some of the film-forming parameters, the device's ability to detect light changes. The aim is to exploit the changes in microscopic structure to improve how well these devices detect light.

Two OSC materials were tested: a small molecule and a polymer, each with different methods for film deposition or change of film-formation parameters. The results showed that even slight modifications in the arrangement of the molecules or polymer segments could lead to differences in how sensitive the structures are to light or how well the phototransistors convert the optical input to an electrical output. Although some challenges with electrical noise affected the performance of the phototransistors, the study highlights that carefully controlling the microstructure of these materials can lead to more efficient light-detecting devices.