Controlling the Solubility and Electrical Conductivity of Organic Semiconductor Films by Reversible Doping

Low solubility limits production of films for organic electronics

Chemical p-type doping, a process where electron acceptor molecules are mixed into an organic semiconductor layer in order to increase conductivity and reduce contact resistance, is vital to the ?eld of microelectronics. In particular, they are crucial for organic electronic devices to work. Although current doping methods have promise, the reactants involved have low solubility and so are not capable of producing high-quality doped films for organic electronics.

New method for p-doping creates more stable electronic devices

Researchers at the Georgia Institute of Technology have developed a new method of p-doping a thin layer of an organic semiconductor and produced several devices based on these. This method is solution processable, allowing great control over the doping of interfaces and bulk materials. It also has low dopant diffusion, creating more stable electronic devices.

The invention is a new method of producing organic semiconductor layers and devices containing these layers through chemical doping. The new method allows greater control of p-type doping than current methods and reversible control of solubility allows layers to be stacked. Furthermore, the doping process has negligible diffusion, resulting in films with increased conductivity, work function and increased resistance to oxidation. This invention can be used in components related to printed electronic devices and organic electronic devices.

Summary Bullets

- This innovation introduces a novel approach for achieving precise p-type doping and reversible solubility control in organic semiconductor layers, thereby enhancing their conductivity and stability.
- It provides solution processability and minimal dopant diffusion, leading to improved performance and versatility for a wide range of electronic devices.

- This technology finds applications in printed electronics, organic solar cells, LEDs, transistors, and sensors, facilitating the production of thin, flexible components with enduring performance.

Solution Advantages

- Solution processable doping
- Reduces sheet resistance and changes the fermi energy of organic semiconductor films
- Enables the manufacture of thin, flexible electronics
- High conversion efficiency
- Stable performance even at 60oC for at least 280 hours

Potential Commercial Applications

- Components related to printed electronic devices
- Organic solar cells and other photovoltaics
- Organic light-emitting diodes
- Organic ?eld-e?ect transistors
- Organic sensors

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IP Status

The patent has issued. : US10763447B2

Publications

Solution-based electrical doping of semiconducting polymer ?lms over a limited depth, Nature Materials - 2016

Images

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