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Highly Stable N-type Organic Conductor from One-pot Polymerization and Doping with Conductivity over 5000 S/cm

A solution-processable n-doped polymer with ITO-comparable conductance and 80% transparency for printable optoelectronics.

Transparent conductors are critical components in optoelectronic devices, ranging from light emitting diodes, solar cells, electrochromic devices, touch screens, defrosting windows, and electromagnetic shielding. Indium tin oxide (ITO) is the most common transparent conductor accounting for 97% of the global transparent conductor market. However, ITO thin films are mechanically fragile, and indium is a rare mineral, leading to concerns over supply and pricing. Researchers at Purdue University have developed a shelf-stable, transparent conductor with high transmissibility and low sheet resistance. The Purdue technology is scalable and yields a highly conductive, stable, n-type solution processable polymer from a one-pot polymerization and doping process. Conductivity is measured to be over 5000 S/cm with a sheet resistance of less than 100 ohms/sq while maintaining 80% transmittance.

Publications:

Highly Conductive and Solution-Processable n-Doped Transparent Organic Conductor. Zhifan Ke, Ashkan Abtahi, Jinhyo Hwang, Ke Chen, Jagrity Chaudhary, Inho Song, Kuluni Perera, Liyan You, Kyle N. Baustert, Kenneth R. Graham, and Jianguo Mei. Journal of the American Chemical Society 2023 145 (6), 3706-3715. DOI: 10.1021/jacs.2c13051

https://www.purdue.edu/newsroom/releases/2023/Q2/purdue-researchers-build-transparent-conductors-without-expensive-rare-earth-indium.html

Technology Validation: The conductive films synthesized using this method demonstrated transmittance of 80% and sheet resistance of 45 ohms/square, which is comparable to that of ITO.

Technology ID
2023-MEI-69956

Category
Chemicals & Advanced Materials/Specialty & Performance Chemicals
Chemicals & Advanced Materials/Polymer Science & Smart Materials
Chemicals & Advanced Materials/Materials Processing & Manufacturing Technologies

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Advantages:

- High transmissibility

- Low sheet resistance

- Shelf-stable

- Solution-processable

- One-pot polymerization and doping

- Easy to pattern

- Durable

Applications:

- Transparent conductor for optoelectronic devices

TRL: 4

Intellectual Property:

Provisional-Gov. Funding, 2022-10-07, United States

Provisional-Gov. Funding, 2022-10-26, United States

Utility-Gov. Funding, 2023-10-25, United States

PCT-Gov. Funding, 2023-10-25, WO

Keywords: Chemistry and Chemical Analysis, Energetic Materials, Environmentally Sustainable, Materials and Manufacturing, Nitrogen Heterocycles, Pharmaceuticals