Low Function Electrodes for Flexible Electronics

A method to significantly reduce the WF of various organic materials

Georgia Tech inventors have developed a method to significantly reduce the WF of various organic materials, including noble metals, transparent metal oxides, conducting polymers, graphene, etc. These materials offer better air stability than the alkaline-earth metals that easily oxidize; however, they typically do not have a WF that is low enough to make them efficient electron-injection or -collection electrodes. Reducing these materials' WF renders them acceptable replacements for the low-WF metals currently used in printed electronics, such as calcium, magnesium, and barium. This technology involves applying to the electrode's surface a Lewis basic oligomer or polymer solution, such as polyethylenimine ethoxylated (PEIE). This ultra-thin layer (~10–50 nm) reduces the electrode material's WF by ~1.0–1.8 eV.

Summary Bullets

- **More stable low-WF materials —** Replaces reactive metals with easy-to-use, stable materials with comparable performance
- **Less complex —** Eliminates the need for a glass barrier or encapsulation layers to protect the material
- **Less expensive —** Lowers the cost of production through faster, easier manufacturing

Solution Advantages

- **More stable low-WF materials —** Replaces reactive metals with easy-to-use, stable materials with comparable performance
- **Less complex —** Eliminates the need for a glass barrier or encapsulation layers to protect the material
- **Less expensive —** Lowers the cost of production through faster, easier manufacturing
- **Environmentally friendly —** Relies on polymers that have a low environmental impact
- **Mass producible —** Can use roll-to-roll mass production techniques

Potential Commercial Applications

This invention could be employed in most electronic and opto-electronic products in the marketplace:

- Organic light-emitting diodes (OLEDs) – e.g., for next-generation televisions
- Organic photovoltaics (OPVs) – e.g., for solar cells and other power-generation devices
- Organic field effect transistors (OFETs) – e.g., for flexible displays
- Organic diodes, sensors, memories, photodetectors, etc.

Background and More Information

This technology improves the performance of printed electronics by changing the work function (WF) of the device's materials. Because more and more electronic products are using organic materials as electrodes, the semiconductive properties of these materials need improving. One way to improve a material's performance is to change its WF—the energy required for thermionic (electron) emission. The lower the WF, the better the power efficiency of the device.

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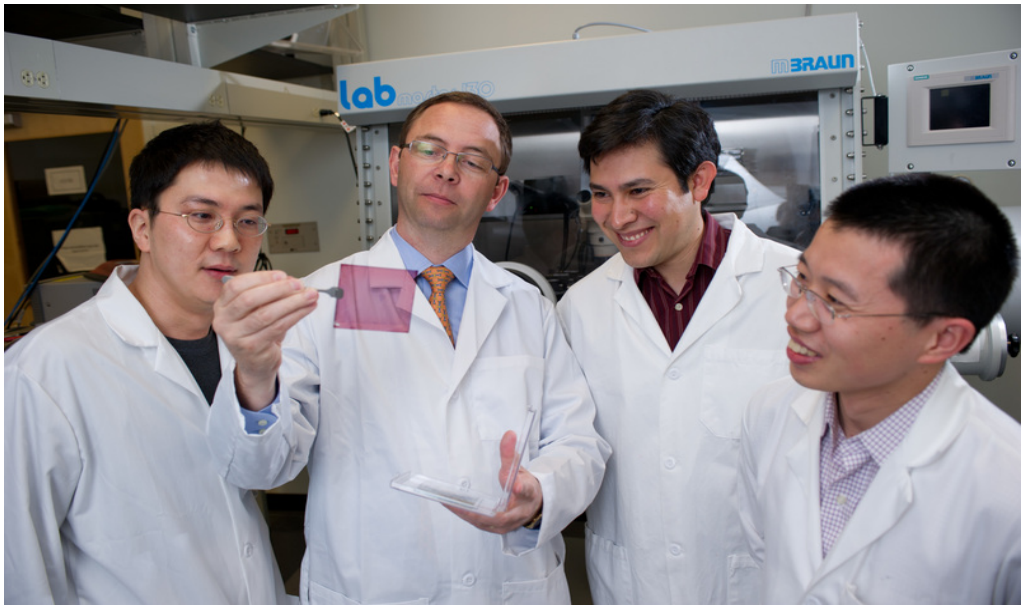
IP Status

Patent has issued : US9203030B2

Publications

Simple Processing Technique Could Cut Cost of Organic PV and Wearable Electronics , -

Images



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