



Zinc Oxide Thin Films Have Higher Electron Mobility

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WARF: P130004US02

Inventors: Paul Evans, Josef Spalenka

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a surface treatment that enhances the mobility and conductivity of semiconducting oxide film.

Overview

Zinc oxide (ZnO) is an inorganic semiconductor with applications in large area photovoltaics and transparent electronics. Producing zinc oxide thin films with excellent electronic properties is challenging and has required a series of processing tools, including vacuum deposition techniques and annealing.

The films can be produced from solution-deposited precursors, enabling industrial (rather than batch) processing and new technologies like electronic circuit printing. However, the films are riddled with defects and impurities, and must be enhanced by subsequent processing steps. These steps typically require very hot temperatures.

The Invention

UW–Madison researchers have developed a room-temperature, solution-based surface treatment that improves the properties of zinc oxide film. The treatment uses molecules that bind to the film's surface to increase electron mobility and conductivity.

In the process, a nanometer-thick film of polycrystalline zinc oxide or an alloy is disposed over a supporting substrate and a layer of organic carboxylic acid-containing molecules. The molecules can be derivatives of saturated fatty acids or photosensitizing dye. They bind to the surface of the film via their linkage groups.

The process is compatible with techniques for manufacturing large area electronics on flexible substrates.

Applications

- Field effect transistors (FETs)
- Transparent electronics, lighting panels and emerging display technologies like organic light-emitting diodes (OLEDs)
- Low-cost solar cells

Key Benefits

- Films exhibit higher electron mobility and conductivity.
- No high temperature processing
- Compatible with roll-to-roll printing
- May improve the performance and transparency of transparent electronics
- Competitive with vacuum-based techniques
- Could enable new technologies

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Stage of Development

Surface-modified zinc oxide film has exhibited a tenfold increase in electron mobility.

Additional Information

For More Information About the Inventors

- [Paul Evans](#)

Related Technologies

- [WARF reference number P100129US01 describes a method for producing single-crystalline zinc oxide thin films.](#)

Tech Fields

- [Semiconductors & Integrated Circuits : Components & materials](#)

For current licensing status, please contact Michael Carey at mcarey@warf.org or 608-960-9867

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