Silver Nanowire-Indium Tin Oxide Nanoparticle As A Transparent Conductor For Optoelectronic Devices
Tech ID: 27209 / UC Case 2012-113-0

SUMMARY
UCLA researchers in the Department of Materials Science and Engineering have developed a novel composite material made of metal oxide nanoparticles (NPs) and silver nanowires (AgNWs).

BACKGROUND
For optoelectronic applications, such as liquid crystal devices, light emitting diodes, and thin-film solar cells, there is a need for flexible, transparent conductors that are easily processable under mild and ambient conditions. Current methods to fabricate conducting metal oxide thin films use complex and costly sputtering techniques that are not compatible with high-throughput roll-to-roll processing. Not only are these techniques not viable for flexible device application because the films formed are brittle and crack easily, but the heating involved can damage the underlying organic layers for organic-based optoelectronic devices. Recent research has focused on incorporating AgNW networks into the metal oxide film, but several issues need to be resolved, including the wire-to-wire junction resistance, surface roughness, and gaps between the nanowires, before they can be a practical option.

INNOVATION
Researchers led by Professor Yang Yang have developed a novel indium tin oxide (ITO) NP-AgNW composite thin film for transparent, flexible optoelectronic devices. This low temperature technique shows improved wire-to-wire junction conductance, smooth surface morphology, excellent mechanical adhesion and flexibility while maintaining the sheet resistance and transmittance values necessary to replace conventional sputtered ITO thin films. As a proof of concept, ITO NPs were embedded into a AgNW mesh, but this method can be further extended to other metal oxide NPs that are less expensive and more abundant, like aluminum doped zinc oxide and antimony doped tin oxide. This will result in a wide range of conductive metal oxide materials to use for a variety of optoelectronic devices.

APPLICATIONS
- Optoelectronic devices
- Thin film solar cells
- Liquid crystal displays
- Touch screens
- Light emitting diodes

ADVANTAGES
- Improved wire-to-wire junction conductance
- Smooth surface morphology
- Excellent mechanical adhesion
- Flexible thin films
- Solution processable

STATE OF DEVELOPMENT
Solution processed thin films of these materials have been formed and characterized. Prototype solar cells made from this material have been fabricated and are in the testing stage.

RELATED MATERIALS

OTHER INFORMATION
Transparent PV Portfolio

CATEGORIZED AS
- Energy
  - Solar
- Engineering
  - Other
- Materials & Chemicals
  - Composites
  - Electronics Packaging
  - Nanomaterials
  - Other
  - Thin Films
- Nanotechnology
  - Electronics
  - Materials

RELATED CASES
2012-113-0

PATENT STATUS
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ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Solution Synthesis and Deposition of Kesterite Copper Zinc Tin Chalcogenide Films
- Conjugated Polymers with Selenium Substituted Diketopyrrolopyrrole Unit for Electronics Devices
- Au Nanoparticles Doped Polyaniline Nanofiber Non-Volatile Memory Device
- Titanium Oxide as the Window Layer for Metal Chalcogenide Photovoltaic Devices
- Novel Polymers for Polymer Solar Cells, Transistors, and Sensors
- Design of Semi-Transparent, Transparent, Stacked or Top-Illuminated Organic Photovoltaic Devices
- Amorphous Silicon And Polymer Hybrid Tandem Photovoltaic Cell
- Efficient and Stable Perovskite Solar Cells with All Solution Processed Metal Oxide Transporting Layers
- A Bi-Functional Lewis Base Additive for Microscopic Homogeneity in Perovskite Solar Cells
- Highly Efficient Perovskite/Cu(In, Ga)S2 Tandem Solar Cell
- A Solution Method To Improve Nanowires Connection And Its Applications In Electro-Related Areas