Novel Polymers for Polymer Solar Cells, Transistors, and Sensors
Tech ID: 27208 / UC Case 2011-558-0

SUMMARY
UCLA researchers in the Department of Materials Science and Engineering have developed a novel class of conjugated polymers for photo-electronic device applications.

BACKGROUND
Conjugated polymers are of interest for active layer materials in polymer-based light emission devices, solar cells, field effect transistors, photodetectors, batteries, supercapacitors, and sensors. They have the potential to lead to low-cost, flexible, lightweight, and easy processable materials for energy generation applications. However, current polymer materials either suffer from a lack of broad solar absorption or relatively low carrier mobility. Previous conjugated polymer-based solar cells have low efficiencies (~7%), leaving a need for new polymer materials that have both high mobility and low bandgaps in order to harvest a broad spectrum of sunlight.

INNOVATION
A research team led by Professor Yang Yang has invented a novel class of conjugated polymers with low bandgaps (1.4 eV-1.5 eV). These polymer materials have a tunable structure and electronic properties, thereby allowing the use of this material to fit into a variety of applications. Implementing these unique polymers into tandem solar cell devices has resulted in power conversion efficiencies as high as 9.5%, which show excellent stability and reproducibility. These devices have better charge transport properties than other similar materials, giving rise to higher open circuit voltage and short circuit current. With optimization, there is a possibility of achieving 15% efficiency.

APPLICATIONS
▶ Organic photovoltaic devices
▶ Tandem solar cells
▶ Light emitting diodes
▶ Field effect transistors
▶ Photodetectors
▶ Batteries and supercapacitors
▶ Sensors

ADVANTAGES
▶ Low bandgap polymers (1.4 eV to 1.5 eV)
▶ Easy structural modification of polymers
▶ Control of optical, electrochemical, and electronic properties
▶ Improved power conversion efficiency
▶ Excellent solar cell stability and reproducibility

STATE OF DEVELOPMENT
Prototype devices with power conversion efficiency as high as 9.5% have been fabricated and extensively tested, with the prospects of reaching 15% efficiency.

RELATED MATERIALS

OTHER INFORMATION
Transparent PV Portfolio

PATENT STATUS

<table>
<thead>
<tr>
<th>Country</th>
<th>Type</th>
<th>Number</th>
<th>Dated</th>
<th>Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States Of America</td>
<td>Issued Patent</td>
<td>10,028,899</td>
<td>07/17/2018</td>
<td>2011-558</td>
</tr>
<tr>
<td>China</td>
<td>Issued Patent</td>
<td>ZL 20120026430.X</td>
<td>09/21/2016</td>
<td>2011-558</td>
</tr>
<tr>
<td>United States Of America</td>
<td>Issued Patent</td>
<td>9,425,420</td>
<td>08/23/2016</td>
<td>2011-558</td>
</tr>
</tbody>
</table>

CONTACT
UCLA Technology Development Group
ncd@tdg.ucla.edu
tel: View Phone Number.
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
- Silver Nanowire-Indium Tin Oxide Nanoparticle As A Transparent Conductor For Optoelectronic Devices
- 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)Se2 Tandem Solar Cell
- A Solution Method To Improve Nanowires Connection And Its Applications In Electro-Related Areas