



## TECHNOLOGY

# Ion Intercalated Transparent Electrodes

## OVERVIEW

### Background:

Transparent electrodes are abundantly used in electronic devices such as displays, touch screens and solar cells. Highly transparent, conductive and flexible material such as graphene and its derivatives are abundantly utilized and studied as transparent electrodes. Large scale graphene based transparent electrodes are usually made with CVD graphene, pristine graphene networks, reduced graphene oxide (RGO) networks, and graphene or RGO hybrid with conductive additive (carbon nanotubes (CNT) and conductive additives). However, CVD graphene suffers a high cost, and graphene/RGO networks obtains low performance due to its intrinsic physical properties. A low cost, high performance, and flexible network transparent electrode is in need for industrial applications.

### Innovation:

Researchers at the University of Maryland have developed an Ion Intercalated Transparent Electrode. This invention includes a metal ion intercalation that can lead to significantly improved performance as a transparent conductor in printed reduced graphene oxide (RGO) networks and RGO/CNT hybrid films. Unlike pristine graphene that inhibits metal ion intercalation, the larger layer-layer distance of RGO allows metal ion intercalation, leading to much higher DC conductivity and, concurrently, optical transmittance. A typical improvement from 36%, 8.3 kohms/sq to 87%, 311 ohms/sq was observed after metal ion intercalation. The transparent conductive film is highly transparent at the infrared region, function as a broadband transparent conductor. As well as stability studies shows that the intercalated thin film is more stable than Li-intercalated graphene.

## APPLICATIONS

- Touch Screens
- Solar Cell
- Electronic displays

## ADVANTAGES

- Improved Sheet resistance
- Improved transmittance
- Low-cost manufacturing
- Broadband transparency (Visible to Infrared, wavelength from 0.1  $\mu\text{m}$  to 20  $\mu\text{m}$ )

## CONTACT INFO

UM Ventures  
0134 Lee Building  
7809 Regents Drive  
College Park, MD 20742  
Email: [umdtechtransfer@umd.edu](mailto:umdtechtransfer@umd.edu)  
Phone: (301) 405-3947 | Fax: (301) 314-9502

## **Additional Information**

### **INSTITUTION**

University of Maryland, College Park

### **PATENT STATUS**

Pending

### **LICENSE STATUS**

Available for exclusive or non-exclusive license

### **CATEGORIES**

- Microelectronics
- Engineering
- Imaging devices

### **EXTERNAL RESOURCES**

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