



# Chromium Complexes Of Graphene

Tech ID: 32703 / UC Case 2011-255-0

## PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,266,738	02/23/2016	2011-255

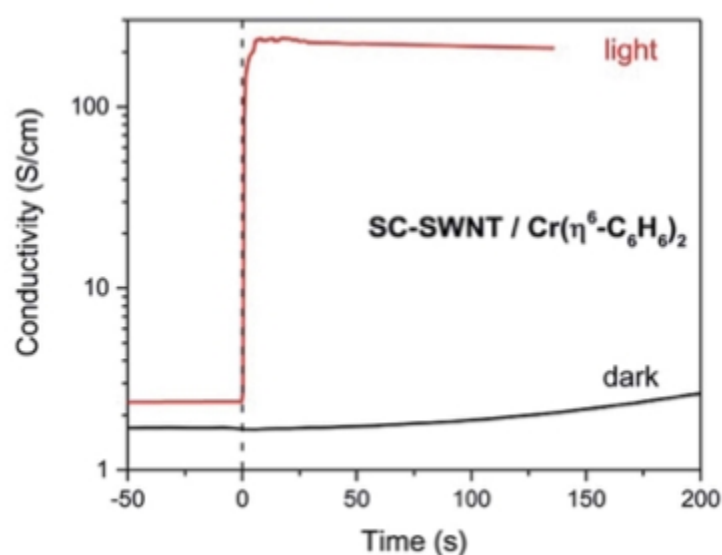
## FULL DESCRIPTION

### Background

Graphene based electronic devices have the potential in achieving high performance in electronic and semiconductor applications because of its unique electronic properties that are complemented by its excellent mechanical and thermal properties. To adequately realize the potential of graphene as an electronic material there is a need to modifying graphene without much perturbation of its conjugated p -electron clouds. Attempts to covalently modify graphene to introduce bandgap have resulted in the hybridization of the  $sp^2$  carbon atoms to  $sp^3$  leading to serious disturbances of the p -electron clouds.

### Current Invention

Inventors led by Prof. Robert Haddon at UCR have developed an innovative, patented system and method for milder covalent modification of graphene without much perturbation of the structural integrity of the  $sp^2$  hybridized carbon atoms. The invention provides a general system and method for hexahapto ( $h^6$ ) complexation of graphene with group 6 transition metals to various extended periodic p -electron systems where the primary  $h^6$  ligand is solely a carbon material.



Evolution of the conductivity of semiconducting SWNT films in the presence of room light and in the dark.

## CONTACT

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## OTHER INFORMATION

### KEYWORDS

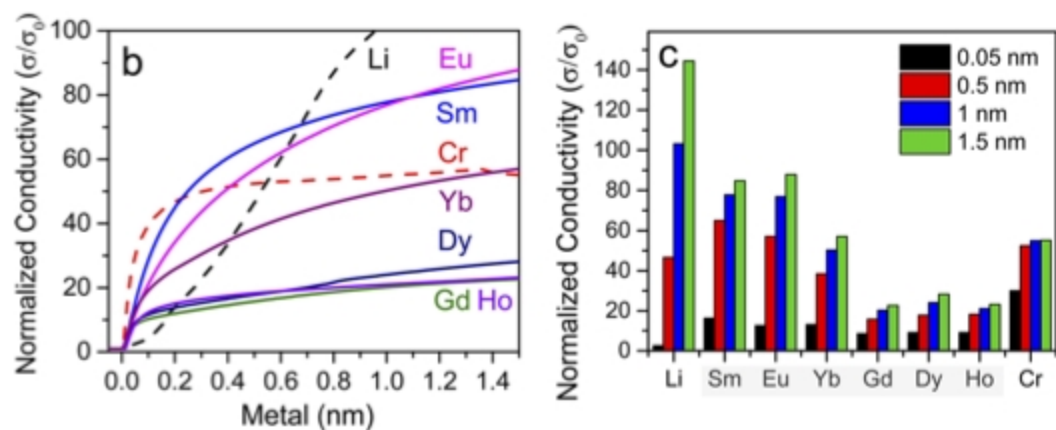
Carbon nanotubes, Single Walled  
 Carbon Nanotubes, SWNT,  
 Organometallic functionalization,  
 Conductivity, Interconnects,  
 Chromium, Carbon nanotube film,  
 lanthanides, Optical properties,  
 Optoelectronics

### CATEGORIZED AS

- ▶ **Optics and Photonics**
  - ▶ All Optics and Photonics
- ▶ **Computer**
  - ▶ Hardware
- ▶ **Energy**
  - ▶ Other
- ▶ **Environment**
  - ▶ Sensing
- ▶ **Materials & Chemicals**
  - ▶ Chemicals
  - ▶ Nanomaterials
  - ▶ Textiles
  - ▶ Thin Films
- ▶ **Nanotechnology**
  - ▶ Electronics
  - ▶ Materials
  - ▶ Tools and Devices
- ▶ **Semiconductors**
  - ▶ Design and Fabrication
  - ▶ Materials
- ▶ **Sensors & Instrumentation**
  - ▶ Environmental Sensors

### RELATED CASES

2011-255-0



Effect of metal deposition on electrical conductivity of semiconducting SWNT films

## ADVANTAGES

The significance and benefits of this invention are:

- ▶ The method is simple, efficient and reproducible.
- ▶ A versatile method for reversible grafting of metal to graphene via  $h^6$  complexation.
- ▶ Provides for a number of routes to de-complexation that returns graphene to its pristine state.
- ▶ Allows for photochemical generation of bis-hexahapto chromium interconnects between the graphene surfaces of single walled carbon nanotubes (SWNT) with significantly enhanced electronic conductivity.
- ▶ Obviates the need for high vacuum reaction vessels.

## SUGGESTED USES

The invention has broad applicability in:

- ▶ Thin film electronics
- ▶ Carbon nanotube film field effect transistors
- ▶ Stretchable electronics and e-skins
- ▶ Organometallic catalysis
- ▶ Ion selective sensors for environmental monitoring

## RELATED INVENTIONS

Please see other inventions by [Prof. Robert Haddon](#)

## RELATED MATERIALS

- ▶ [Organometallic chemistry of extended periodic p-electron systems: hexahapto-chromium complexes of graphene and single-walled carbon nanotubes](#)
- ▶ [Photochemical generation of bis-hexahapto chromium interconnects between the graphene surfaces of single-walled carbon nanotubes](#)
- ▶ [Effect of Lanthanide Metal Complexation on the Properties and Electronic Structure of Single-Walled Carbon Nanotube Films](#)
- ▶ [Effect of constructive rehybridization on transverse conductivity of aligned single-walled carbon nanotube films](#)

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