

# Technology Commercialization Opportunity

## Production of graphene, graphene oxide, graphene metal composites and coatings

### Background and Technology Description

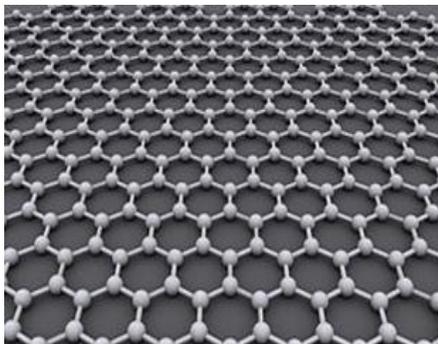
Graphene is considered a wonder material and is among the highest in both electrical and thermal conductivity; additionally it is exceptionally strong. It is viewed as a material that can revolutionize the electronic industry as it approaches quantum computing. Graphene's unique properties are not limited to just electronics as new technological applications are being discovered.

#### GRAPHENE MATERIAL

Thermal Conductivity	5000-5500 W m <sup>-2</sup> k <sup>-1</sup>
Young's Modulus	1100 GPa
Specific Surface Area	2630 m <sup>2</sup> /g
Fracture strength	125 GPa
Electronic mobility	>15000 cm <sup>2</sup> V <sup>-1</sup> s <sup>-1</sup>
Tensile strength	130 GPa
Mobility	40,000 cm <sup>2</sup> V <sup>-1</sup> s <sup>-1</sup>
Resistivity	1.0 μohm-cm

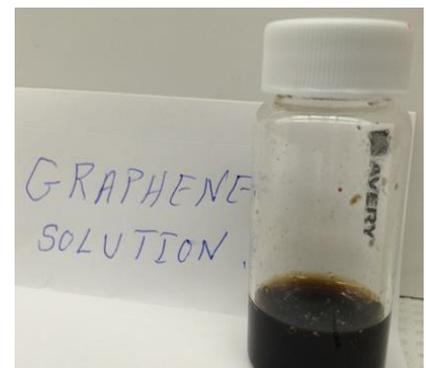
Currently graphene can be synthesized by at least ten different methods. This new innovation at Rochester Institute of Technology (RIT) is an efficient method of producing graphene that has several advantages, some of which make it a less expensive and more consistent.

General Properties of Graphene



One atomic layer network of carbon atoms, [en.wikipedia.org](http://en.wikipedia.org)

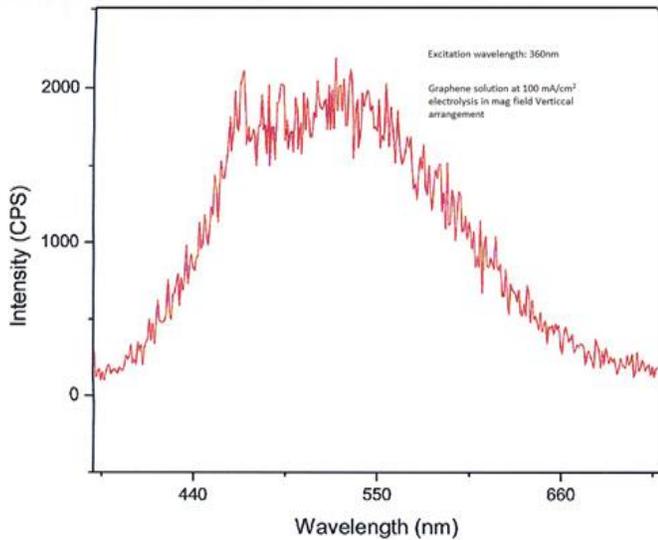
Ever since the discovery of graphene was made public, there have been innumerable technological attempts at making this wonder material, both chemical and physical. The chemical methods can be either chemical vapor deposition (CVD) of graphene or preparation of graphene or graphene oxide in colloidal suspension. A physical method involves the use of a high power laser to cleave the graphite to a single layer. There are several steps involved in both the



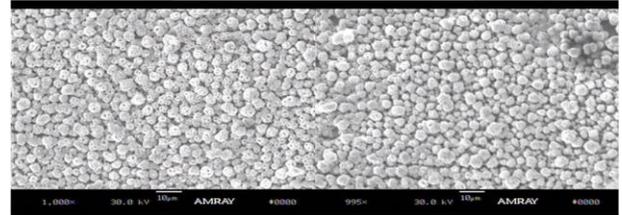
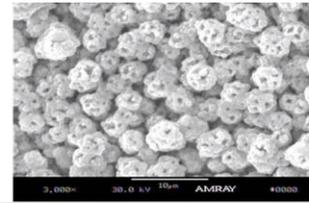
Graphene solution ready to be used

methods which require additional purification steps of the material during production. Our new technology involves simultaneous production of graphene/graphene oxide in a colloidal suspension and a coating of it on an electrically conducting substrate. The coated substrate can also be pure graphene. The colloidal suspension can be used directly for coating metal or non-metal substrates; by varying the conditions of productions metal-graphene composites can be produced.

**Keywords:** Preparation of graphene compounds, Pool boiling applications, Electronics industry, Coating metals for corrosion protection, Optoelectronic industries, Structural material



Fluorescence spectrum of the solution.



Copper electrochemically deposited on graphene using dip coated graphene



Graphene deposited on copper metal

### Technology Readiness

The currently available technology is based on laboratory scale experiments that provide small volumes of graphene solutions. Scalability seems highly feasible.

Idea	Concept	Prototype	Alpha Version	Beta Version	Released
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### Intellectual Property

This technology is the subject of a pending RIT patent application.

### Target Customers/Applications

**Quantum dots, electronic interconnects, structural materials, coating of substrates**

### Opportunity

RIT's Intellectual Property Management Office (IPMO) is interested in working with qualified parties who are interested in the commercialization of this automated system.

### Contact

Those interested in learning more about this opportunity should contact: **Mr. William E. Bond**, Director of Intellectual Property Management at RIT (585) 475-2986 [bill.bond@rit.edu](mailto:bill.bond@rit.edu)

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