



Graphene and Beyond: Recent Progress in the Production of 2D Materials

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Full Spectrum of Graphene Products:



Graphene nanoplatelets



Graphene TEM grids

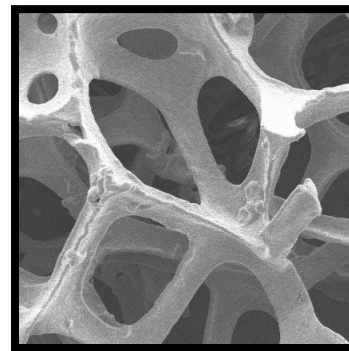


CVD graphene

Graphene oxide



3D graphene foam



Equipment for Graphene Processing



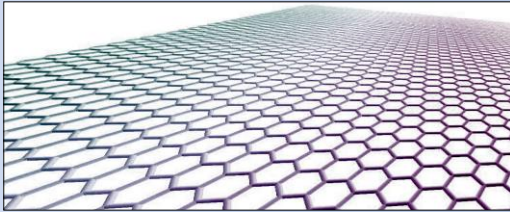
CVD System for Graphene Growth



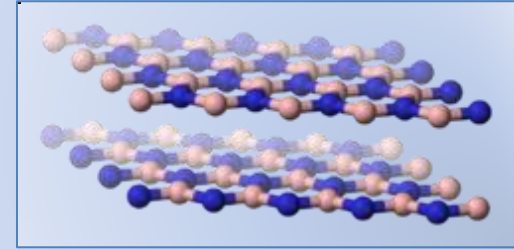
SpeedMixer™ Mixer System

Going Beyond Graphene

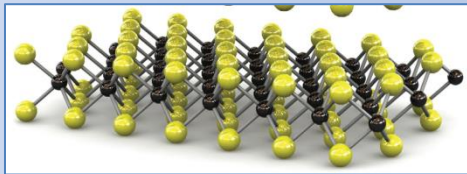
Semimetals: Graphene



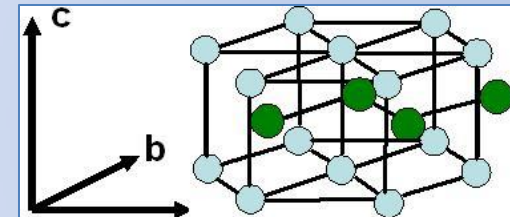
Insulators: BN



Semiconductors: WS_2 , MoS_2 , $MoSe_2$



Superconductors: $NbSe_2$



Future Applications

We will need ALL these components

Conductors

Semiconductors

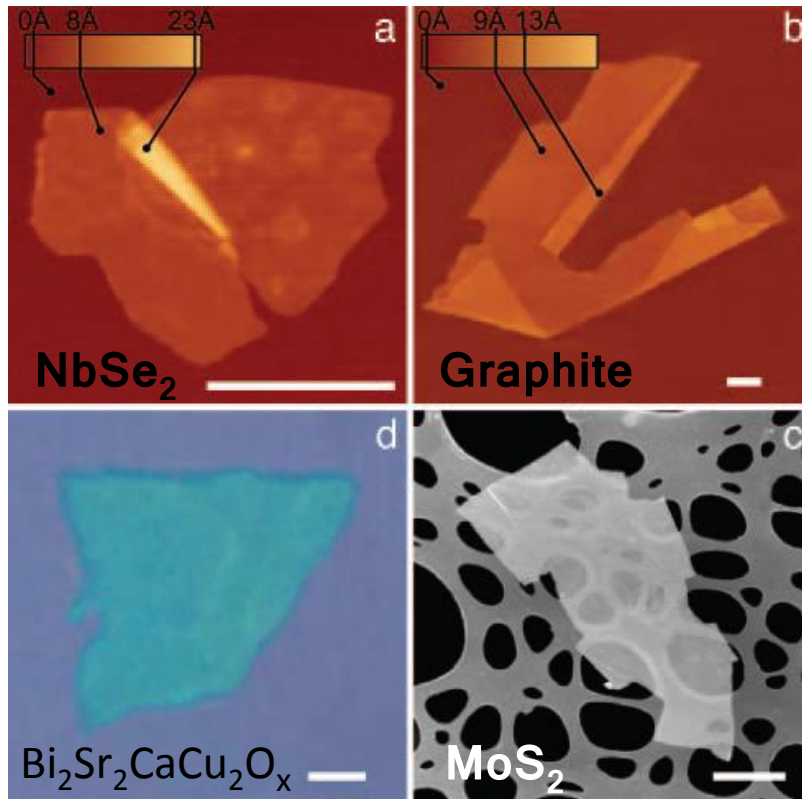
Light Emitters

Insulators

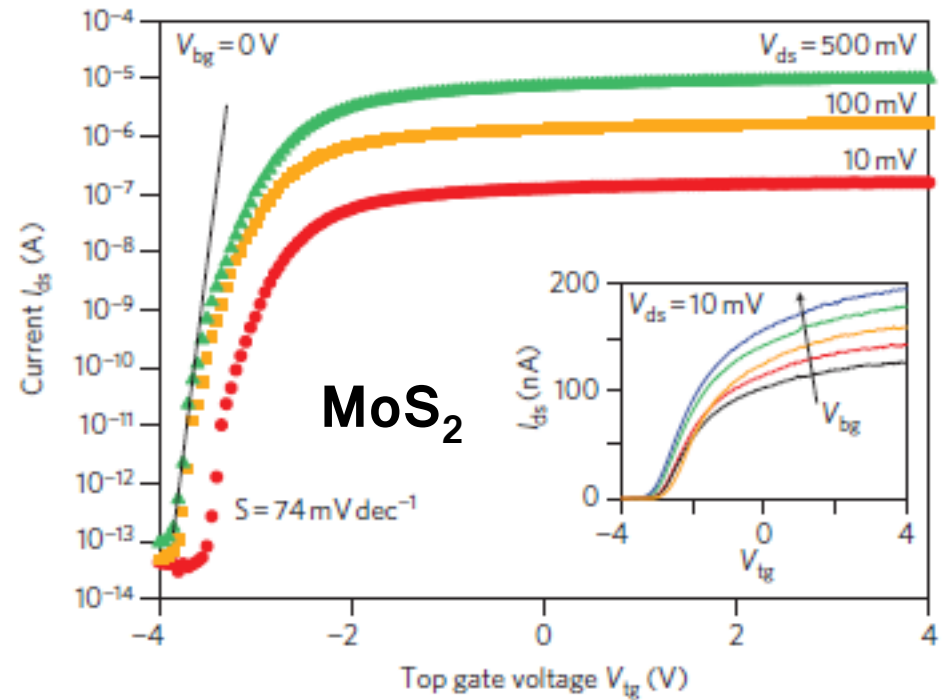
Optical
absorbers

Going Beyond Graphene

Two-dimensional atomic crystals



Spark of Interest



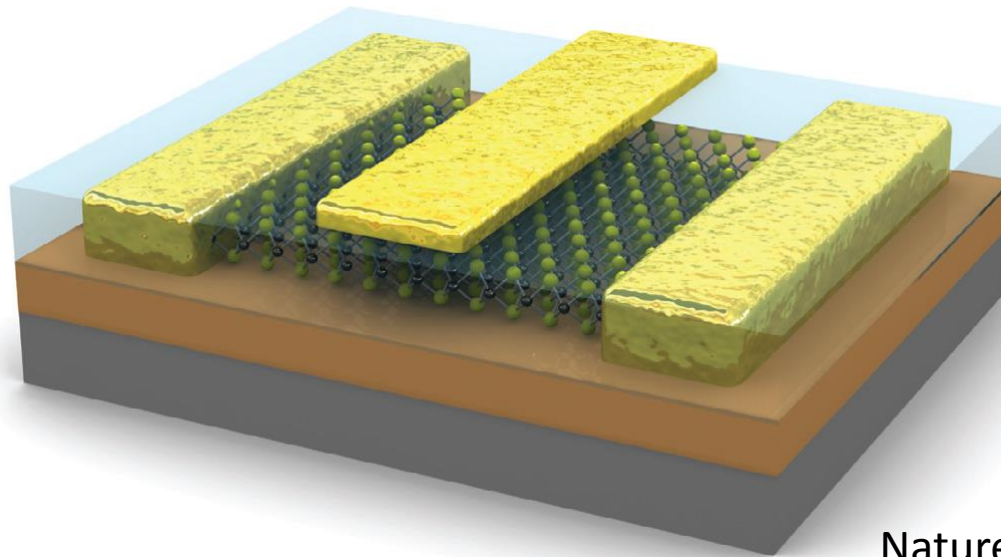
A transistor that works!

PNAS, July 26, 2005, v.102, 30, 10451

Nature Nat, 2011, vol. 6, 147

For which applications do 2D layered materials have better a shot than graphene?

- Hybrid Materials
- Chemical and biosensors
- Photoelectronics
- Low-power Electronics
- Solar cells
- Composite Materials



Nature Nat, 2011, vol. 6, 147

Graphene Laboratories: Outline

Operator of Graphene Supermarket



- **2009:** Founded by Dr. Elena Polyakova (CEO) and Dr. Daniel Stolyarov (CTO)
- **2010:** Manchester Scientists won the Nobel Prize in Physics for the characterization and isolation of graphene
- **2011:** Graphene Labs moves to the Stony Brook Incubator in Calverton, NY
- **2012-13:** New staff members hired, facilities are expanded



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Lomiko Metals Strategic Alliance

- Lomiko Metals is a Canada-based junior exploration company
- Graphite from Lomiko's Quatre Milles has been shown to have a mean purity above 98%
- In early 2013, Graphene Labs and Lomiko signed a Strategic Alliance Agreement



Purpose and Goals of Strategic Alliance

- For high quality graphene made from graphite, high quality precursor must be used
- Lomiko's high quality raw material has strong potential as a precursor for graphene materials
- Create a industrial-scale supply chain of graphene materials

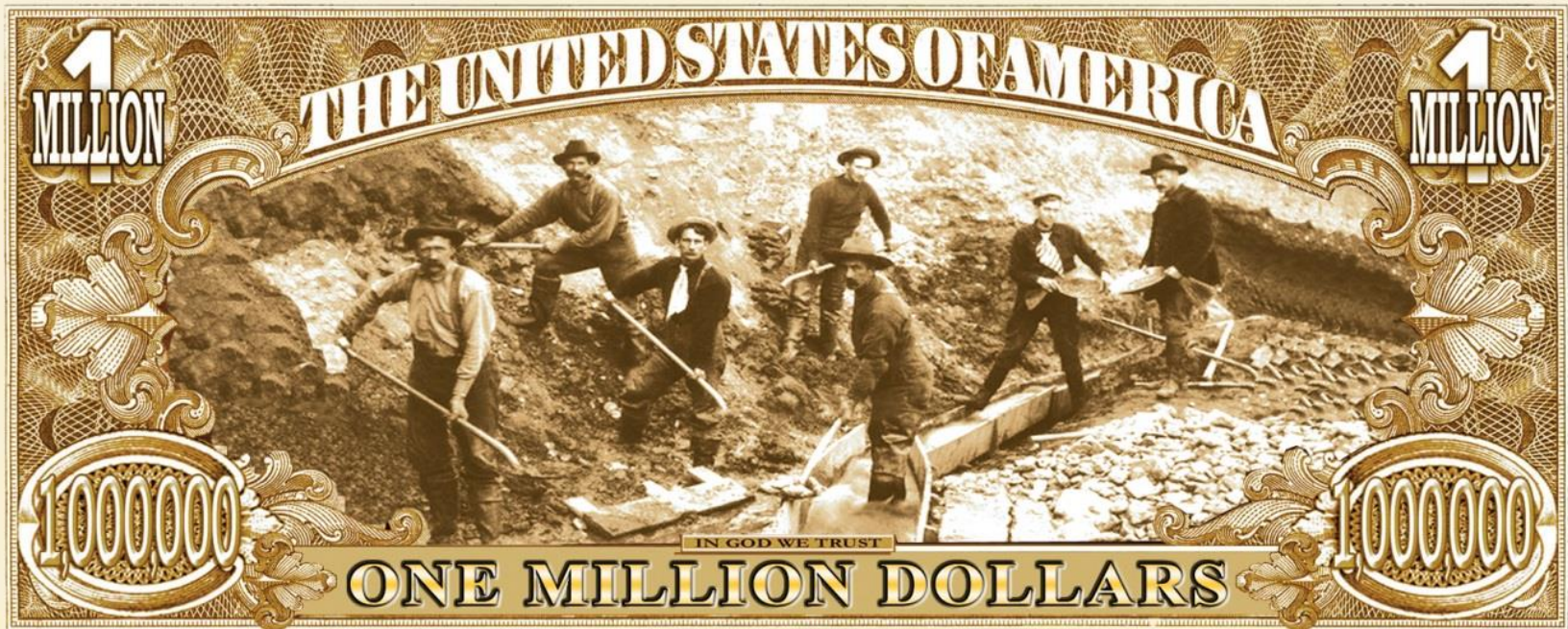
Media Coverage



Experts in 2D
Materials

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Graphene Gold Rush



Current Overview

Graphene Laboratories is:

- Self-sustaining manufacturing and sales enterprise
- Integrated with Long Island scientific and business community
- Internationally recognized company with thousands of customers
- Consistently expanding line of products



Graphene: Evolution vs. Revolution

Commercialization of Graphene Materials

Graphene-enhanced products

Replacement of current technology

Graphene-enabled products



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Better Materials for 3D Printing

We specialize in offering our customers high performance graphene materials to be used in demanding 3D printing applications.

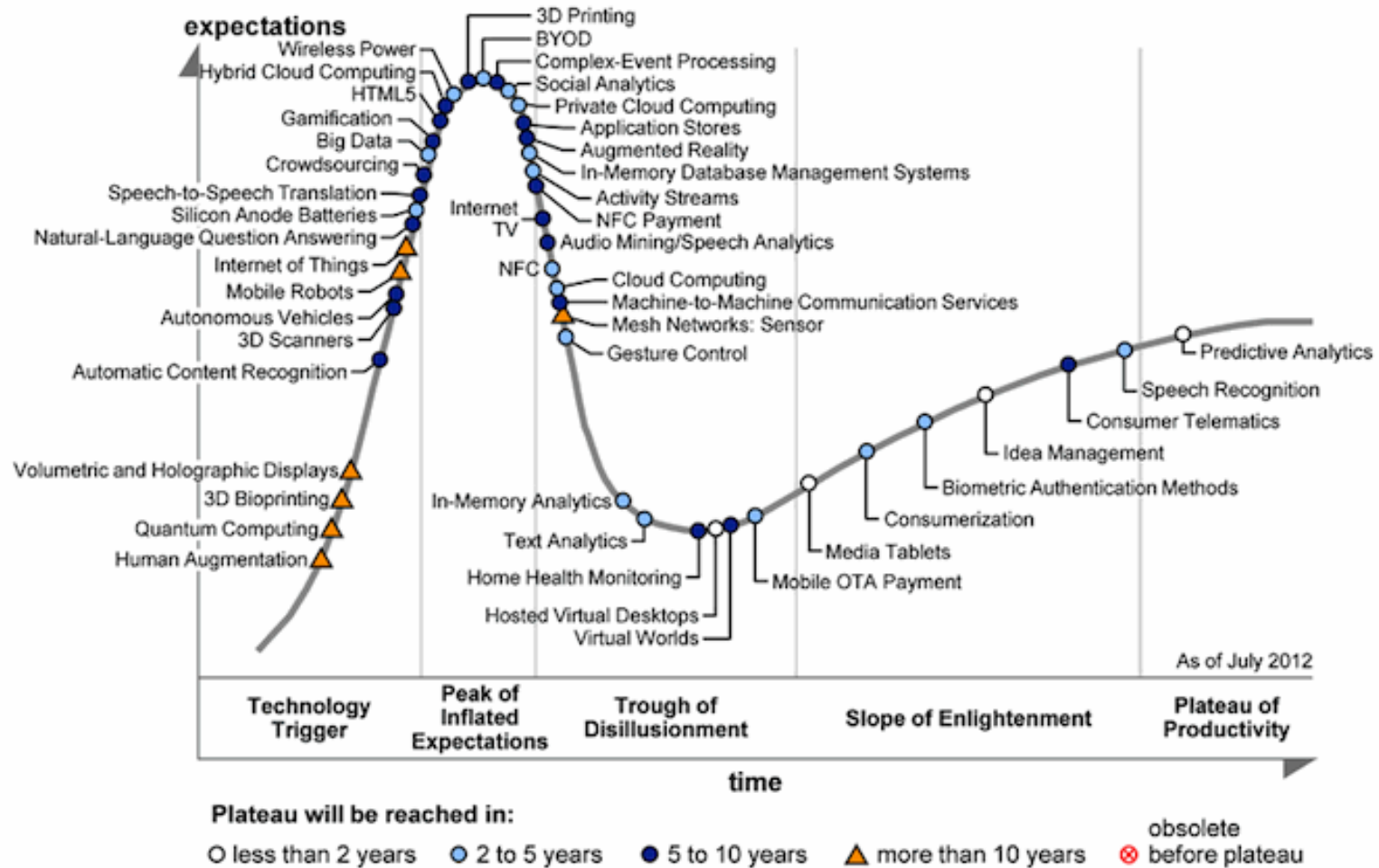
Additive manufacturing: 3D printing



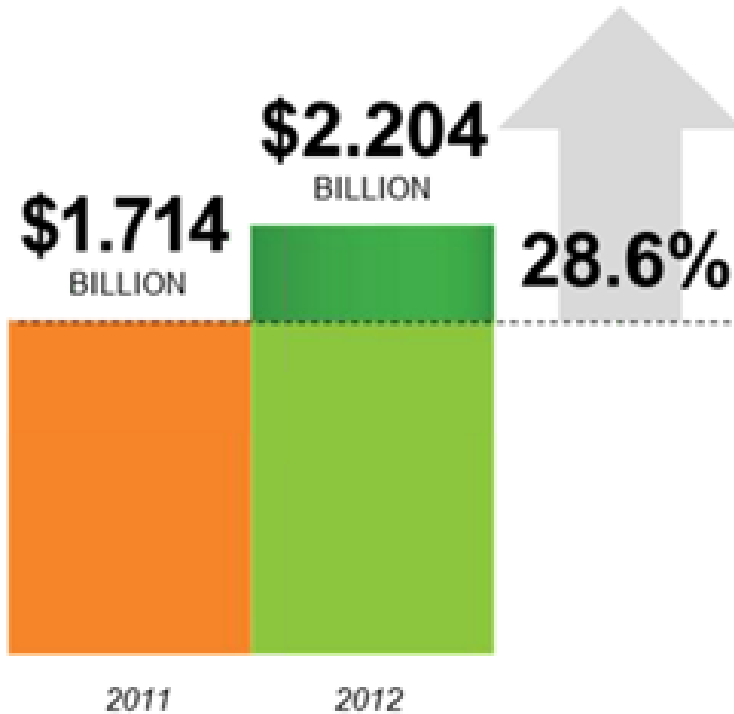
Additive manufacturing is a new way of making things including tools, clothing furniture and musical instruments.



Graphene: Where are we now?



3D Printing Global Market (consisting of all products and services)



Source: Wohlers Associates <http://wohlersassociates.com>

Additive Manufacturing (3D Printing): Business Perspectives

- The World market for (including products and services) is expected to grow by 28.6% in the next year
- President Obama highlights 3D printing in his State of the Union address in January 2013
- The novel manufacturing method will require novel materials

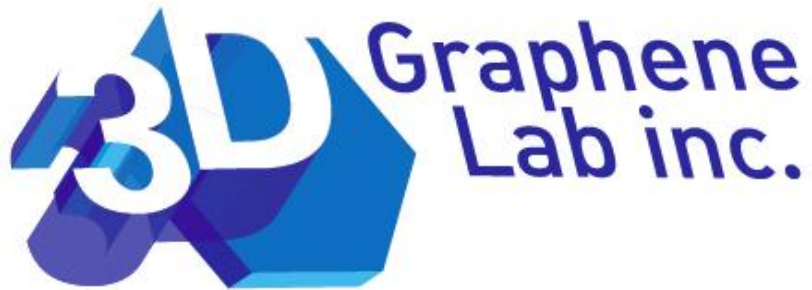
Advantages of Graphene Materials for 3D printing

- Graphene-polymer nanocomposites can be used together with a matrix polymer in the same printing process, thereby adding extra functionality to printed parts.
- The nanoscopic size of graphene platelets allows printing with high resolution.
- Graphene is also considered a “green” material;
- The chemical inertness of graphene would allow the parts manufactured by 3D printing to be used, even in an aggressive chemical environment.

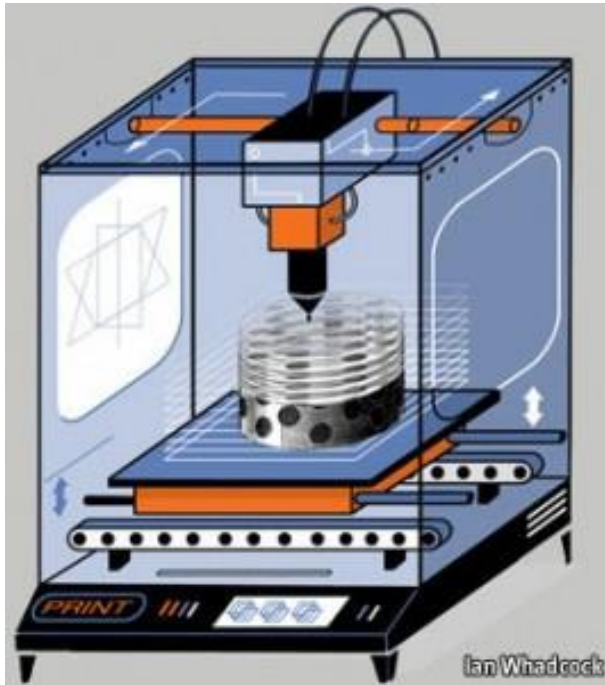
Electrically conductive graphene composites for 3D printing



Electrically conductive polymers can be used for incorporating electrical circuits into the printed objects.



- Graphene 3D Lab is the spinout of the Graphene Laboratories Inc focused on commercialization of the graphene-enabled nanocomposites for 3D printing
- We have proprietary technology for preparation of the graphene based composites which we are planning to use for making materials for Fusion Deposition modeling





Thank you for your attention!

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