

EasyTube® SYSTEMS

The FirstNano® EasyTube® CVD systems are designed with R&D, pilot, and volume production customers in mind. The systems can process substrates up to 300 mm x 300 mm.



CVD systems configured for graphene up to 50 mm and 100 mm substrate sizes, respectively



CVD system configured for graphene up to 200 mm substrate sizes



CVD system configured for graphene up to 300 mm substrate sizes

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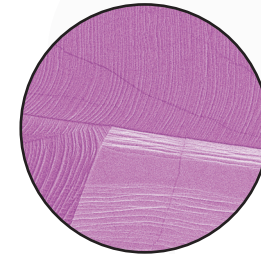
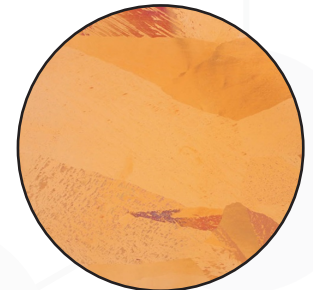
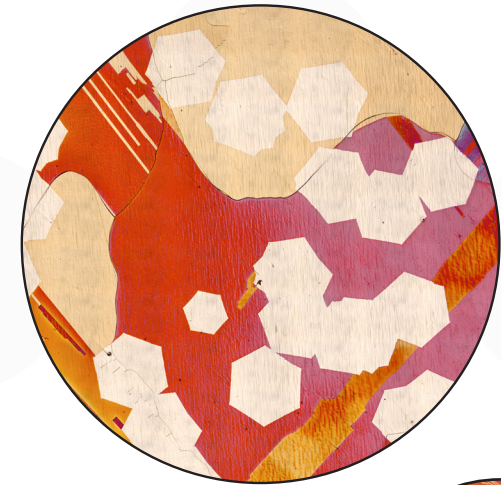
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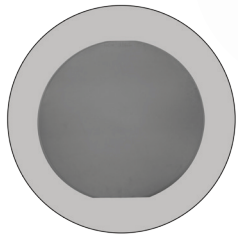
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Graphene Capabilities

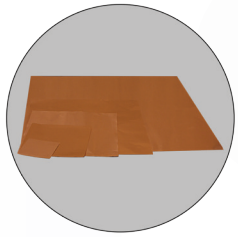
Uniform mm-Sized CVD Graphene Growth



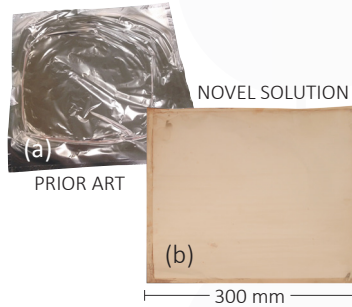
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WAFER

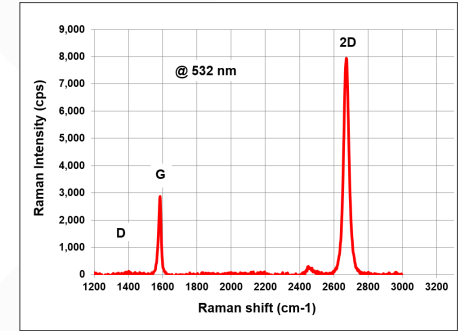


FOIL



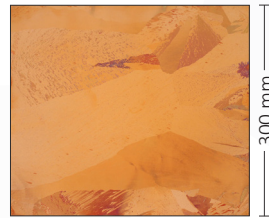
300 mm x 300 mm copper foil subjected to 2 hour annealing and 2 hour CVD graphene growth

- (a) Processed at 15 Torr and 1020 °C with traditional tube furnace system
- (b) Processed with a FirstNano® EasyTube® system incorporating a proprietary patent pending processing solution resulting in CVD graphene on wrinkle-free Cu foil



Raman spectrum of single layer CVD graphene film made with a FirstNano® EasyTube® system

The graphene film was transferred onto a glass substrate before the Raman measurement.



Multi-centimeter size copper crystal grains obtained over a 300 mm x 300 mm area

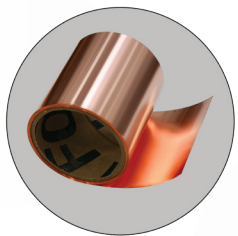
Annealed for one hour in a FirstNano® EasyTube® system and removed at 200 °C to rapidly oxidize the copper foil. Different copper grains oxidize at different rates, thus resulting in different colors.

PROCESS SOLUTIONS

Wide range of substrates can be processed

UNIQUE ADVANTAGES

Uniform growth of mm-sized hexagonal single crystal graphene

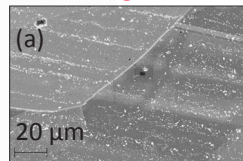


ROLL

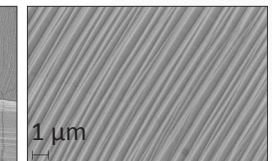
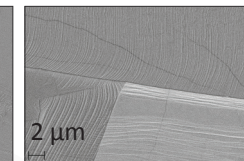
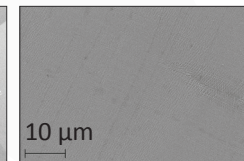
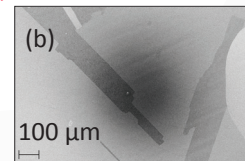


FOAM

SEM images of CVD graphene on Cu foil



PRIOR ART



NOVEL SOLUTION

(a) **Using a traditional CVD graphene system**

The 'white dots' are SiO₂, CuOx, and other particulates that have contaminated the graphene film

(b) **Using a FirstNano® EasyTube® system and an EasyGraphene™ enclosure box**

> 1000 X less particulates are observed

PATENT PENDING tooling for uniform graphene growth

