7th edition of the largest European Conference & Exhibition in Graphene and 2D Materials

Graphene 2017
March 28-31
Barcelona (Spain)

A different approach to graphene based products industrialization.

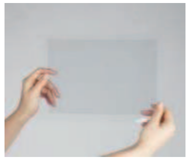
NEXT
next generation materials

Simone Ligi

Graphenes

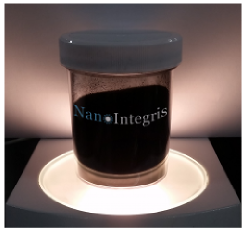
Graphene can be produced by many different techniques with varying complexity and cost. This results in a wide range of graphene derivates and quality.

- Graphene CVD
  - Very large monolayer sheets
  - Complex, high T technology
  - Price: 16.000-200.000 $/m2



: https://www.graphenesq.com/product

- Plasma graphene (GNP)
  - Small sheets with varying thickness
  - Price: 10.000-30.000 €/kg



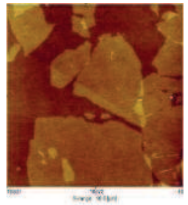
http://raymor.com/our-products/pureware-graphene/

- Pristine graphene, the Nobel prize graphene
  - Perfect material produced by peel off.
  - Price: 6,8 T$/m^2

Flake Areas (μm^2)	1600 (monolayer), 2500 (bilayer), 1000 (trilayer)
Substrate	90nm SiO_2 on n-doped 525µm Si
Price	£750

http://grapheneindustries.com/?Sample+Catalog

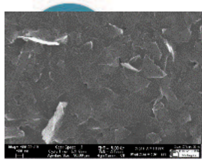
- Graphene oxide (GO):
  - Functionalize defective graphene, electrical insulator
  - Price: 400-3000 €/kg



- Reduced graphene oxide, RGO:
  - Electrically conductive
  - Price: 2000 - x €/kg for powder

http://www.graphenea.com/products/

- Few layer graphene (FLG)
  - Small sheets with varying thickness
  - Price: 100-3000 €/kg



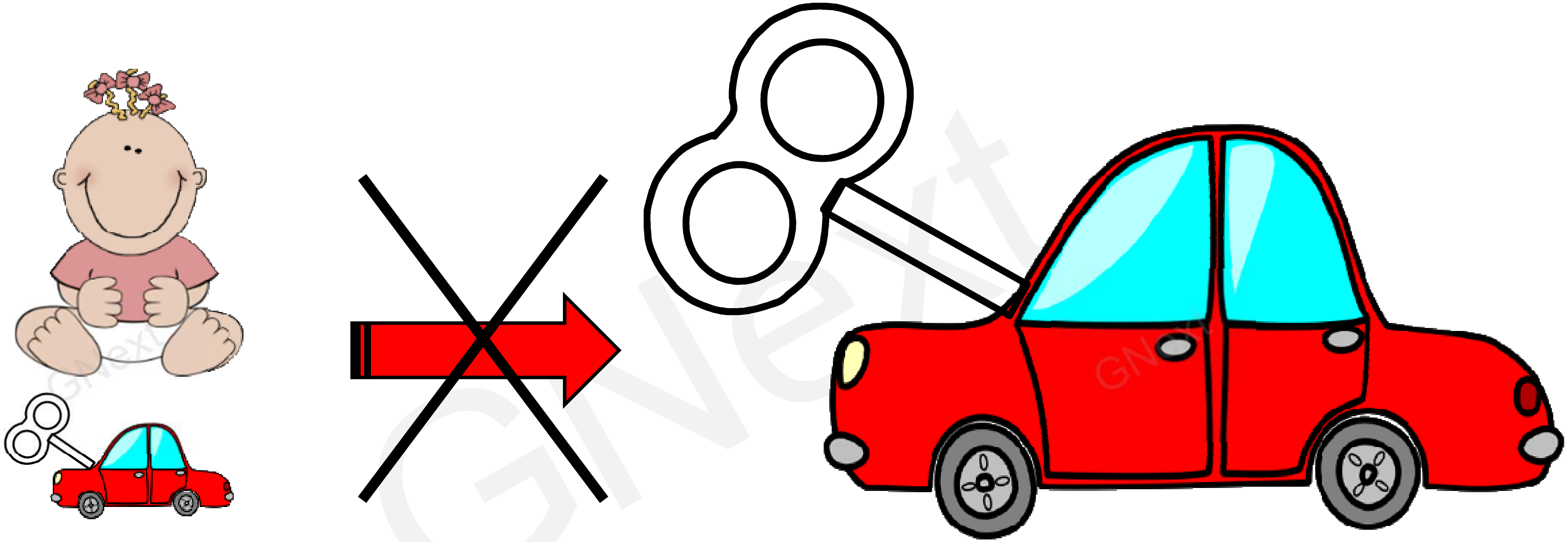
What’s on the table

- Price: 100$/kg up to 200k$/m^2.
- Type: graphene, CVD graphene, few layer graphene, graphene oxide, reduced graphene oxide, etc.
- Different quality even within the same producer.
- Difficult to use.

Researcher’s graphene

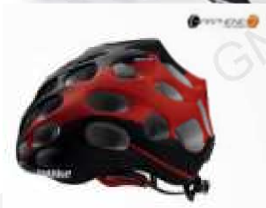
Graphene on the market

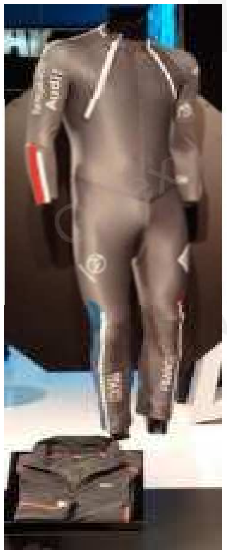
Scale up



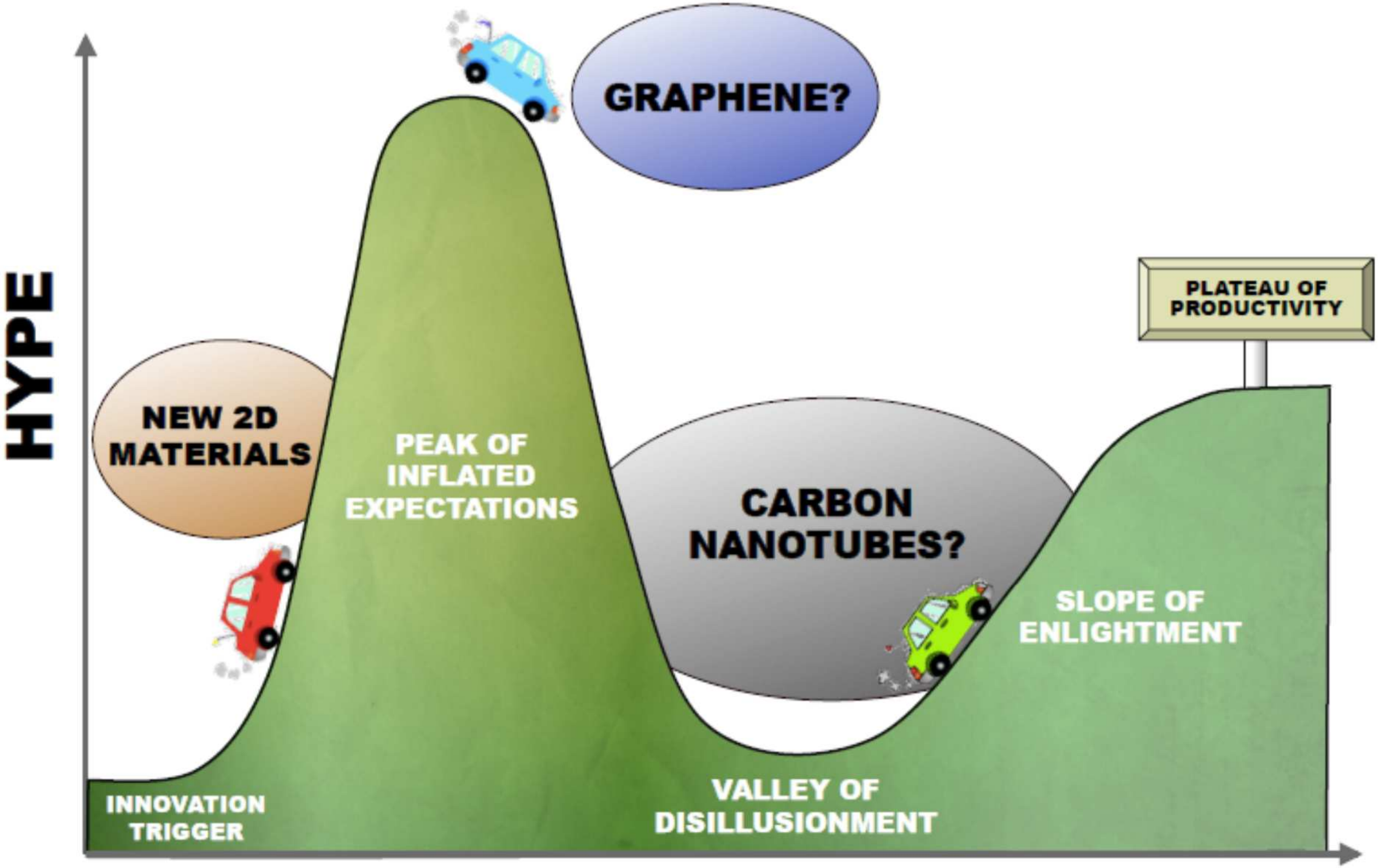
Greater discovery, higher time required
to apply it.

Famous commercial products





Going to be depressed?



Palermo, Kinloch, Pugno, Ligi, Adv. Mat. DOI: 10.1002/adma.201505469

New concept

Graphene pristine

Graphene CVD

2,6 B€ revenue 2015

Graphene FLG

110,6 B€ revenue 2015

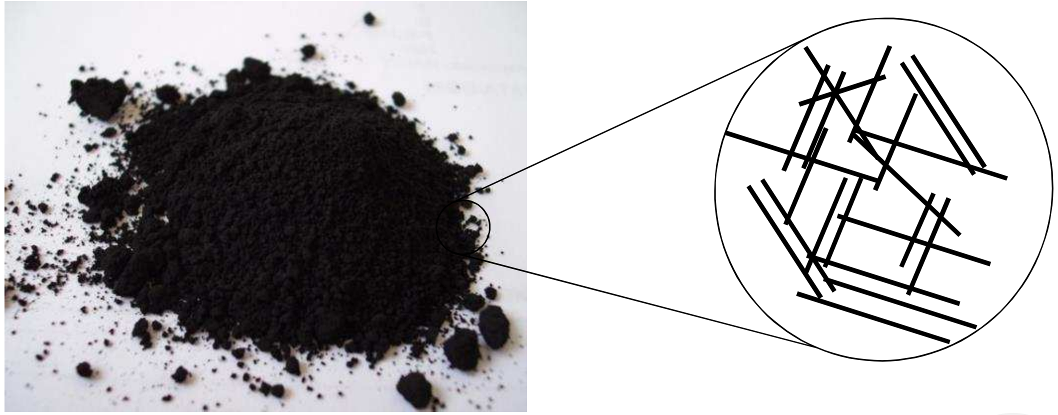
GNext FL graphene

www.graphene-xt.com

- Graphene suspended in water
- Low amount of exfoliating agent
- No oxidation process
- No volatile chemicals
- Green chemistry applied to all process
- Patented

There is a beauty in simplicity

Powder vs suspended



Advantages

- Pure material

Disadvantages

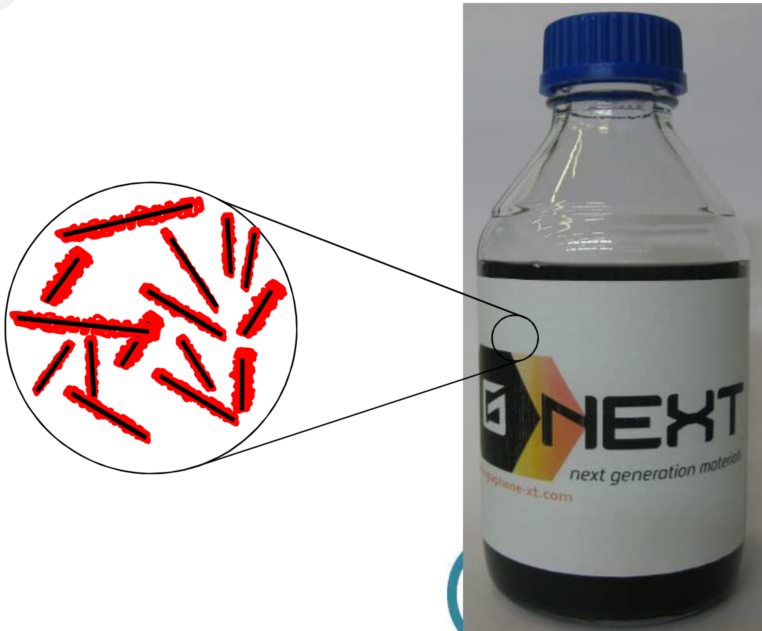
- Difficult to handle and mix

Advantages

- Easy to handle

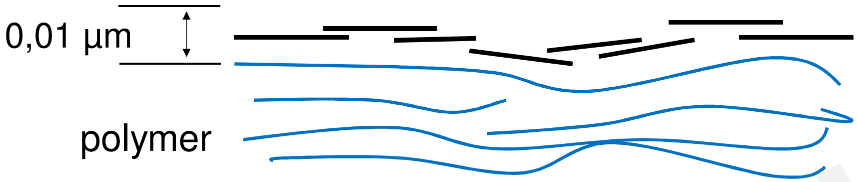
Disadvantages

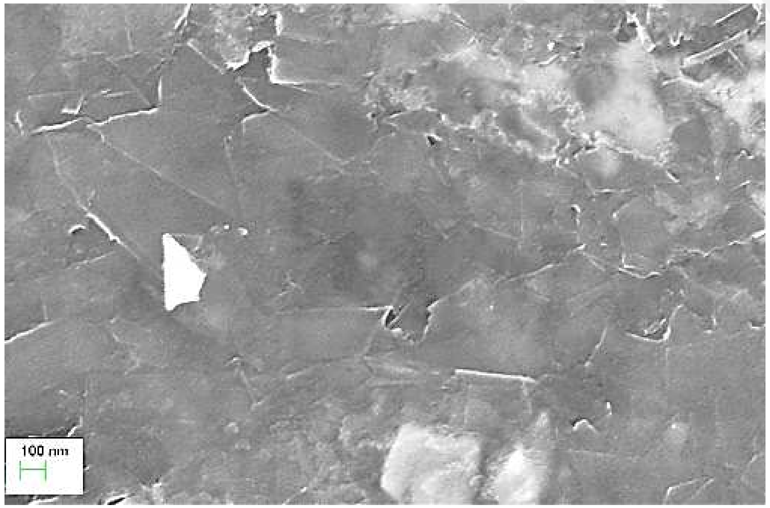
- Low graphene concentration



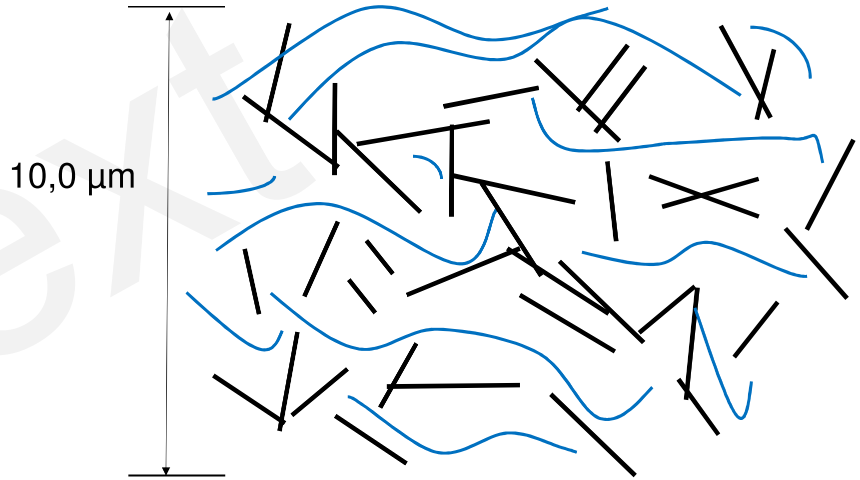
Coating vs bulk

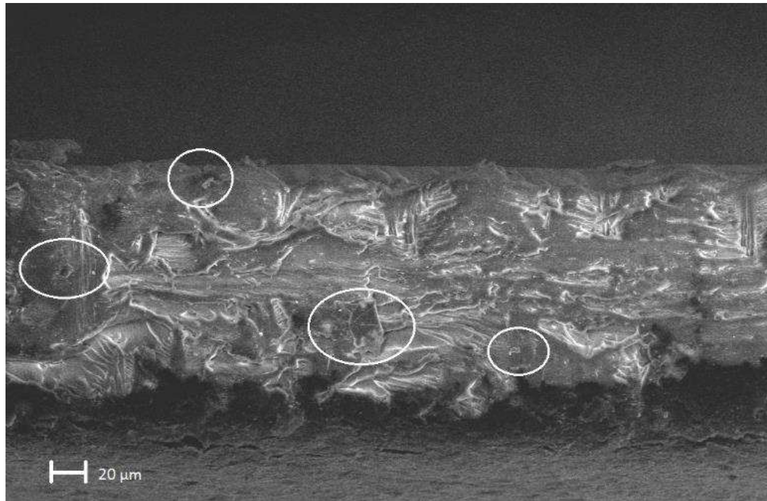
Conductivity reached with <0,3 % weight of FLG GNext





Conductivity reached with 30 - 50 % weight of FLG

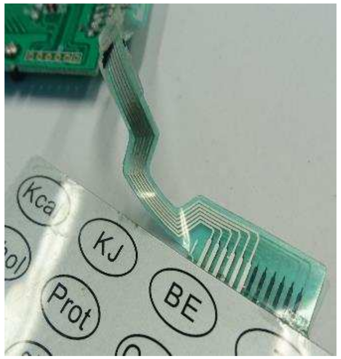




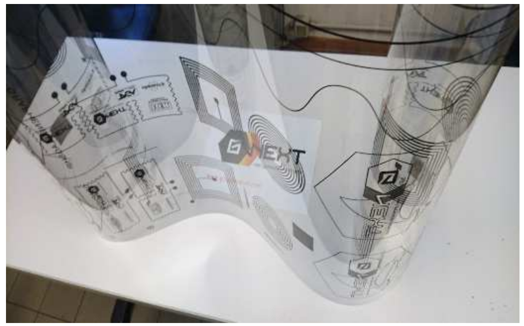
Used for?

- Antistatic, ESD/EMI shielding
- Polymer – metal – polymer

- ✓ GNext replace the metal with graphene
- ✓ Polymer – graphene (– polymer) now you can recycle it



- Flexible electronic, keypad, sensor
- Actually with lithography, silver ink or carbon black
- Cost and durability are the issue

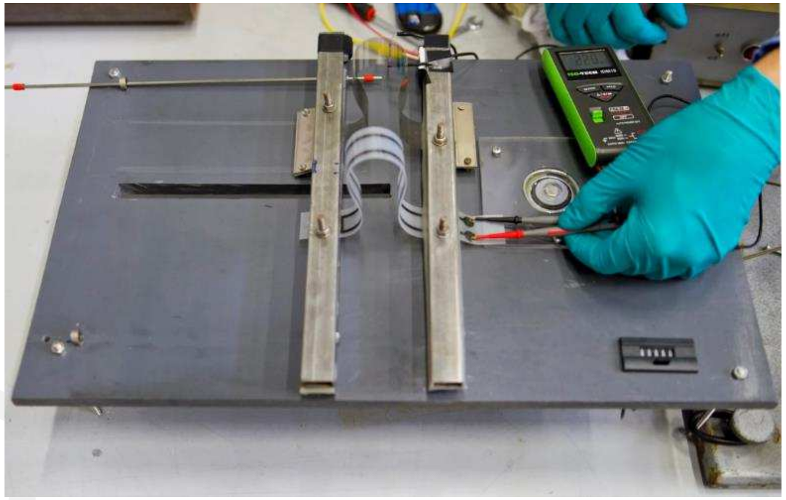


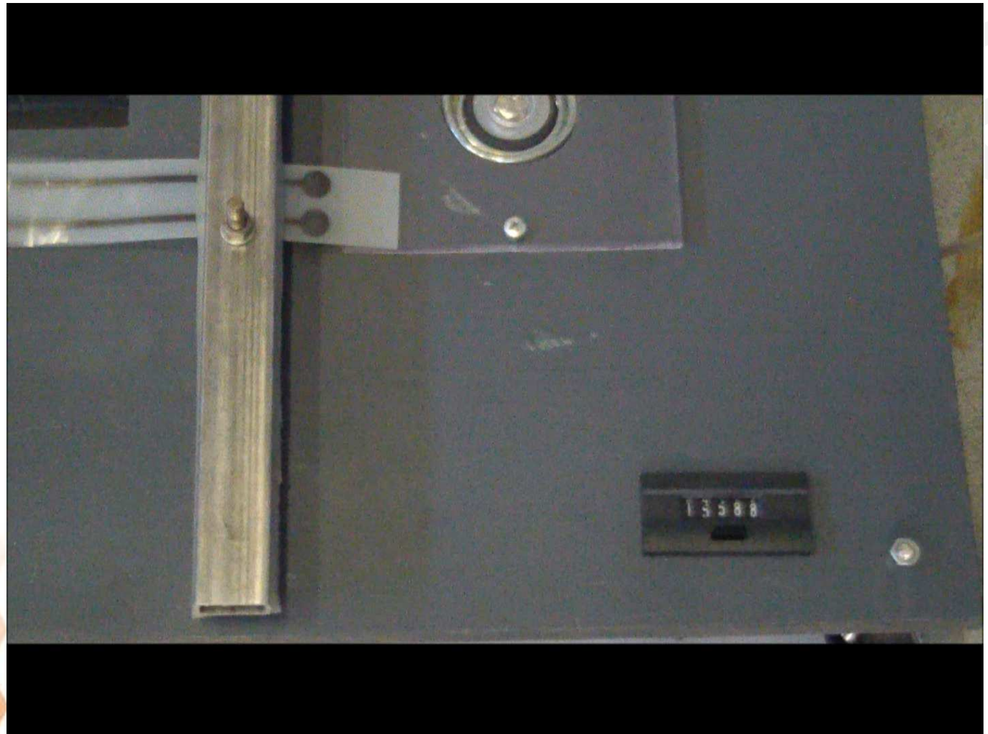
- ✓ We print low amounts of graphene at good conductivity, low cost → standard equipment
- ✓ High chemical stability and mechanical durability

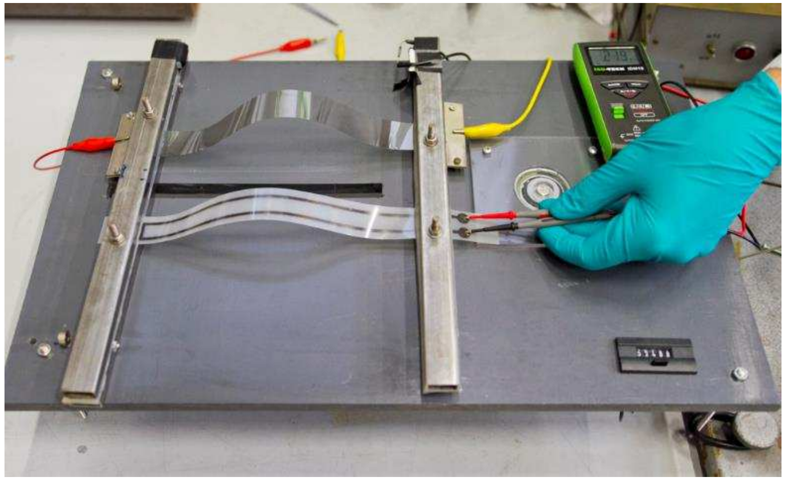
Bending stress test

www.graphene-xt.com

60.000 bend without
any resistance variation

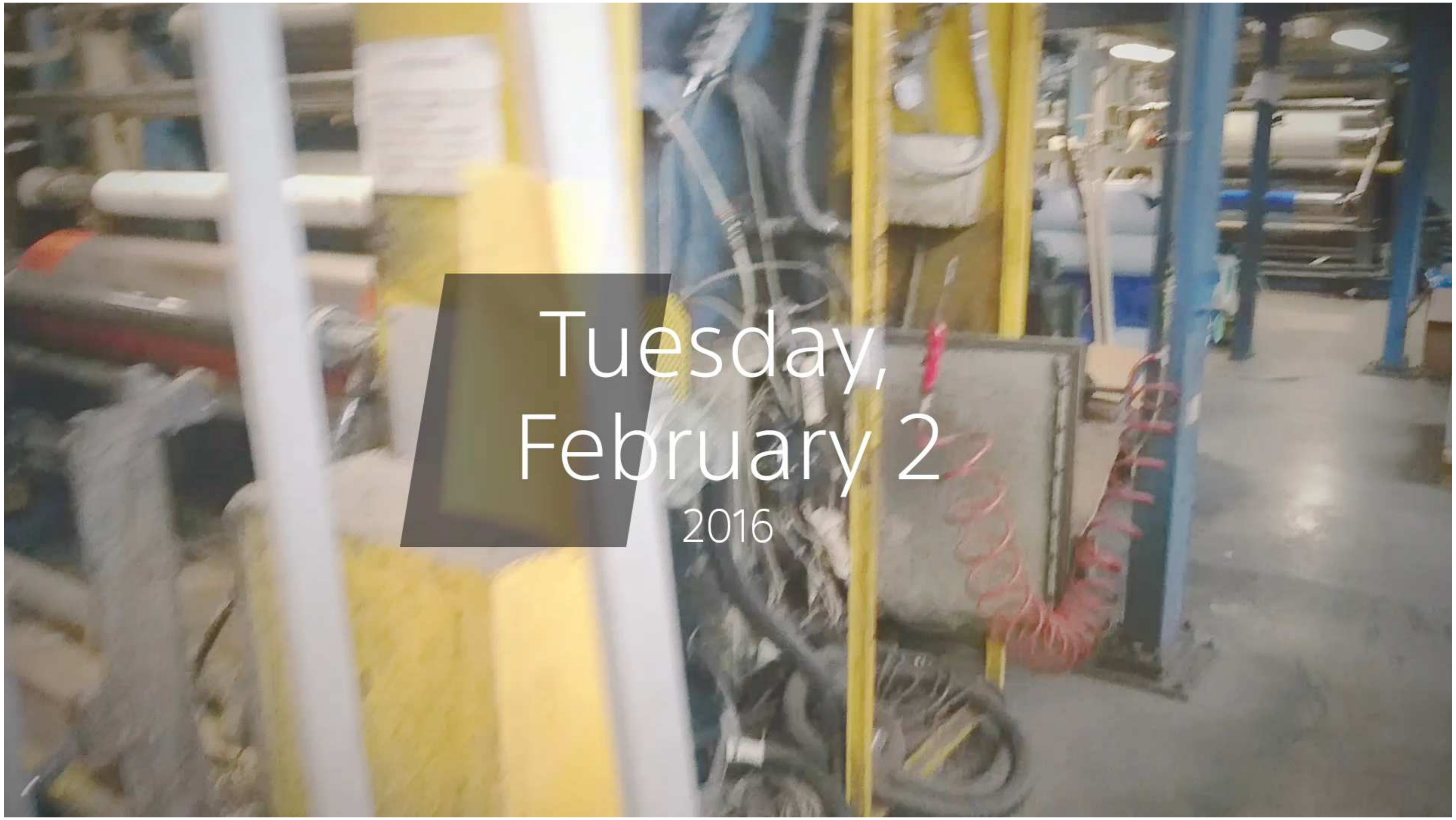






Industrial production

www.graphene-xt.com



1,5 mt width at 60-100 mt/min

Industrial production


- GNext can coat: metals, plastic, glass, ceramic..
  sheet resistance up to **20 ohm/sq**
- We are only chemical researchers, so we use strategic industrial partners for large scale production.

- Film capacity 150.000 m^2/y

- Ink capacity 40.000 m^2/y fully printed area
- Limited by the market, potential hundreds Mm^2/y

Nice box or nice present?

Basic style but great performance

THANK YOU