

Investigation Report of Graphene

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Synthesis Method

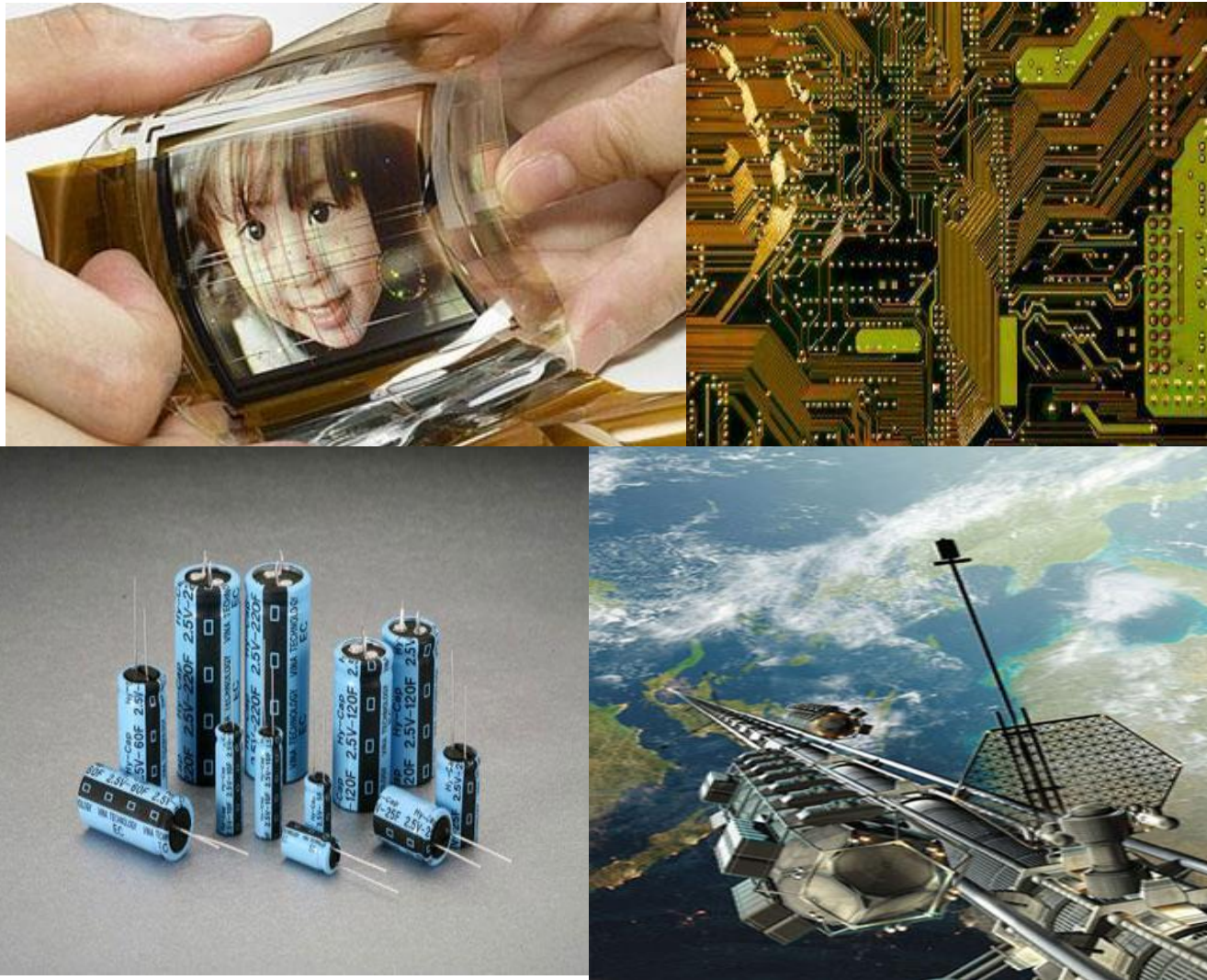
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Omnipotent Graphene



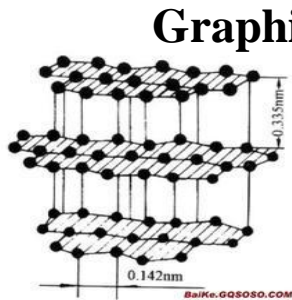
Graphene will change the history of human !!!

Basic Knowledge Of Graphene



Carbon

long ago



Graphite

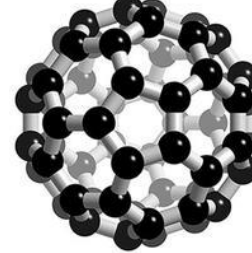
then

Diamond



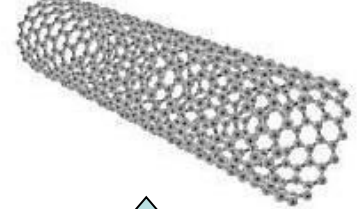
3000 years ago

Fullerene



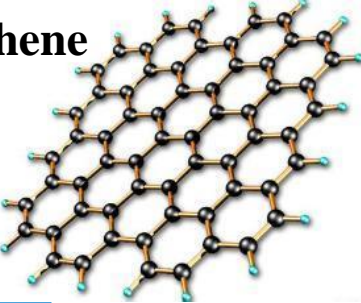
1985

Carbon Nanotube

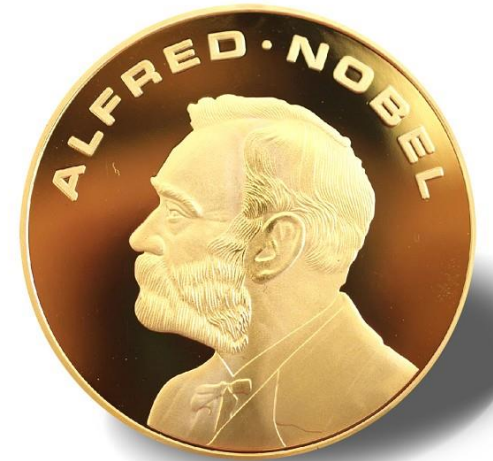


1991

Graphene

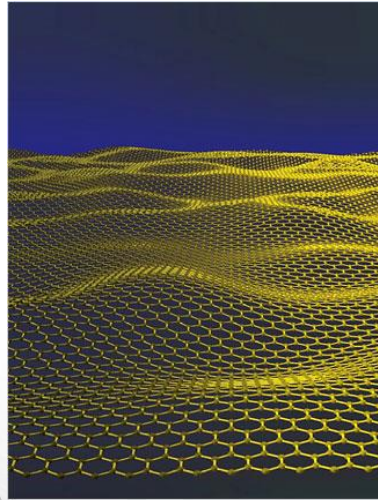


2004



Novoselov K S, Geim A K, Firsov A A. *Science*, 2004, 306:666-669.

Basic Knowledge Of Graphene——Unique properties



$15000 \text{ cm}^2 \cdot \text{V}^{-1} \cdot \text{s}^{-1}$
in room temperature

High electron
mobility

Never disappear

Conductivity

Half integer
quantum Holzer effect

Graphene

The highest
intensity

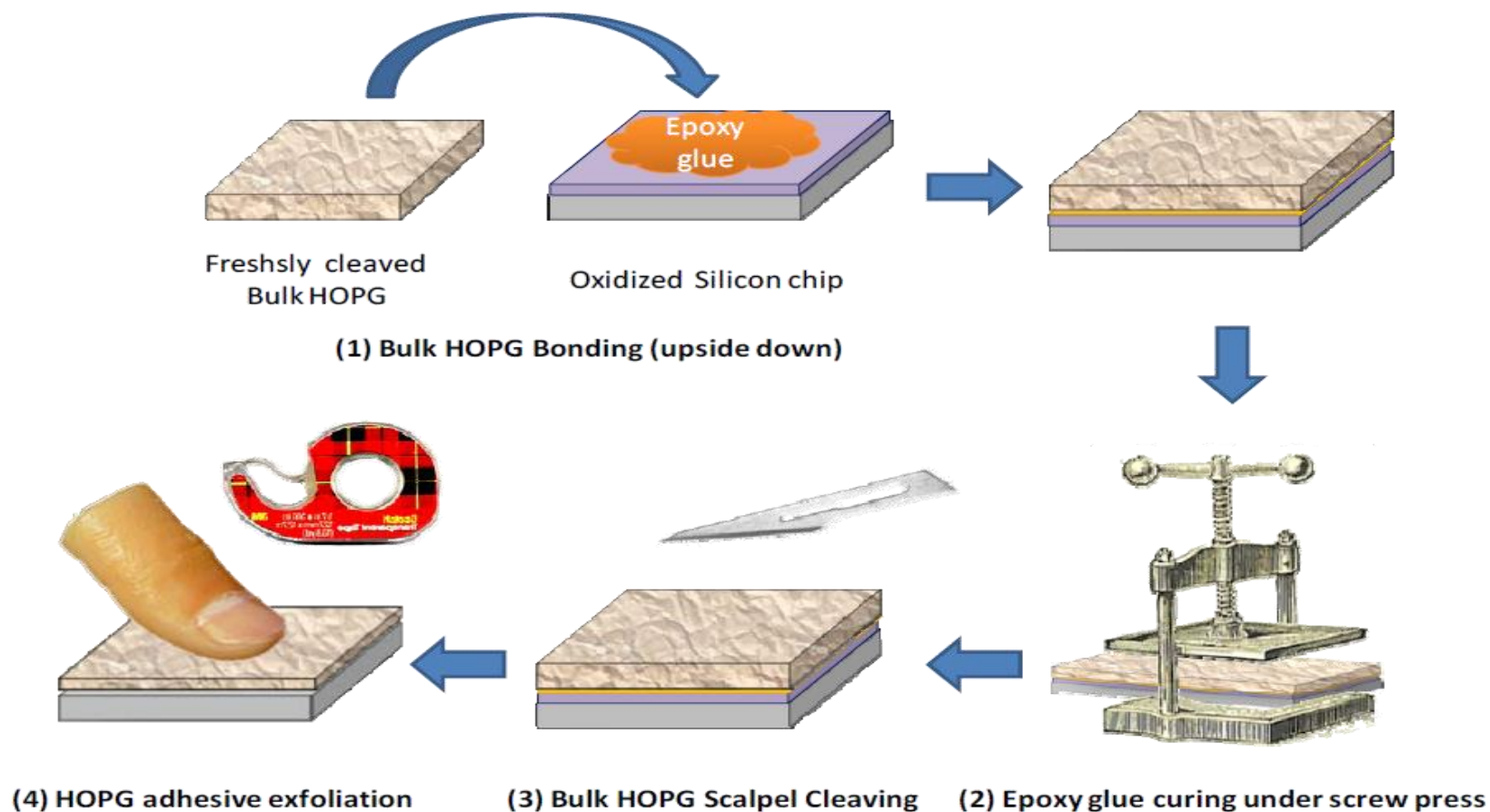
about 1060 GPa

An atomic layer
thickness

Thinnest

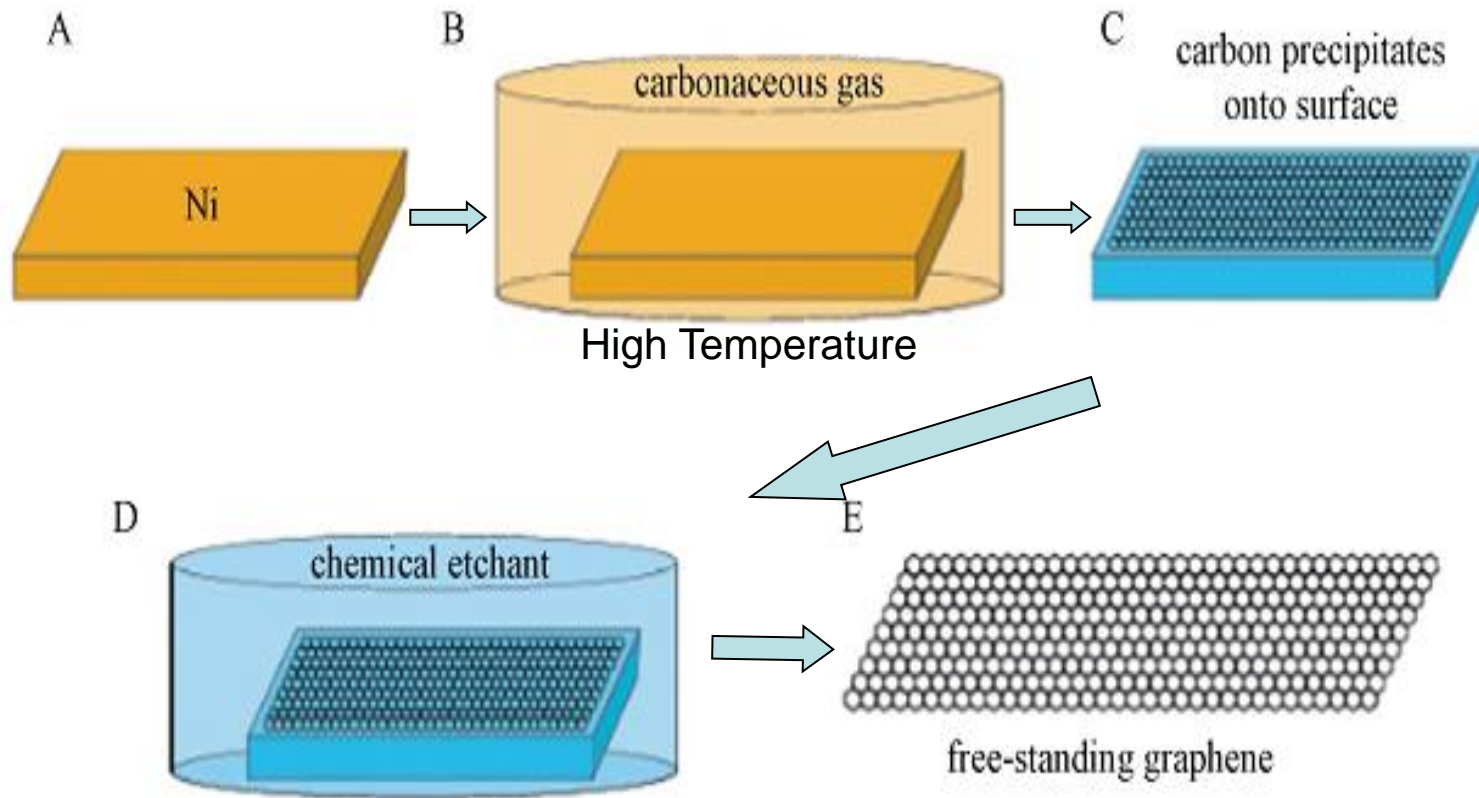
Synthesis Method Of Graphene——Physical method

Micro mechanical stripping method of HOPG



Synthesis Method Of Graphene——Chemical method

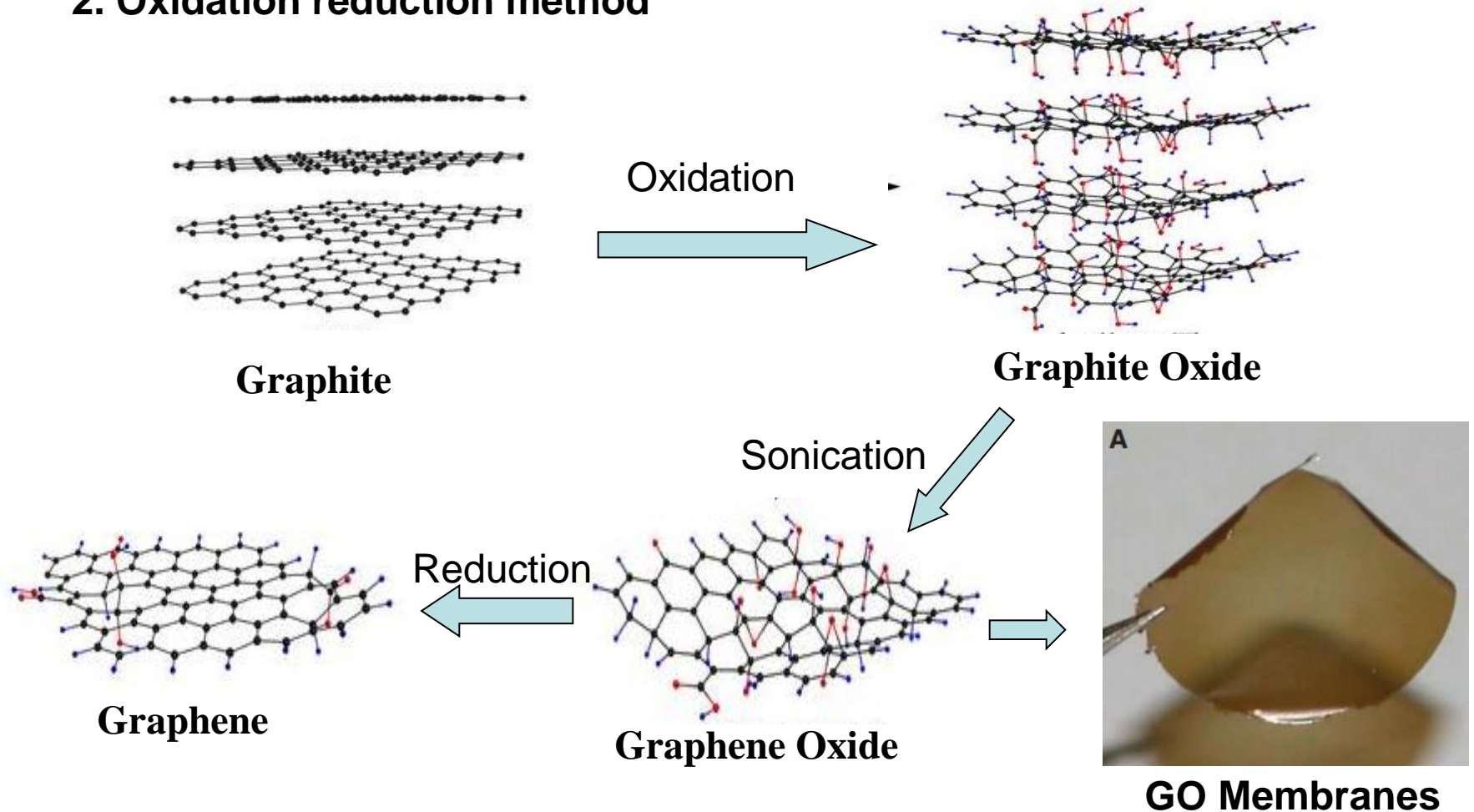
1. Chemical Vapor Deposition, CVD



Kim Ks,Zhao Y,Jang H,et al, Large—scale pattern growth of graphene films for stretchable transparent electrodes[J]. Nature,2009,457:706—710 .

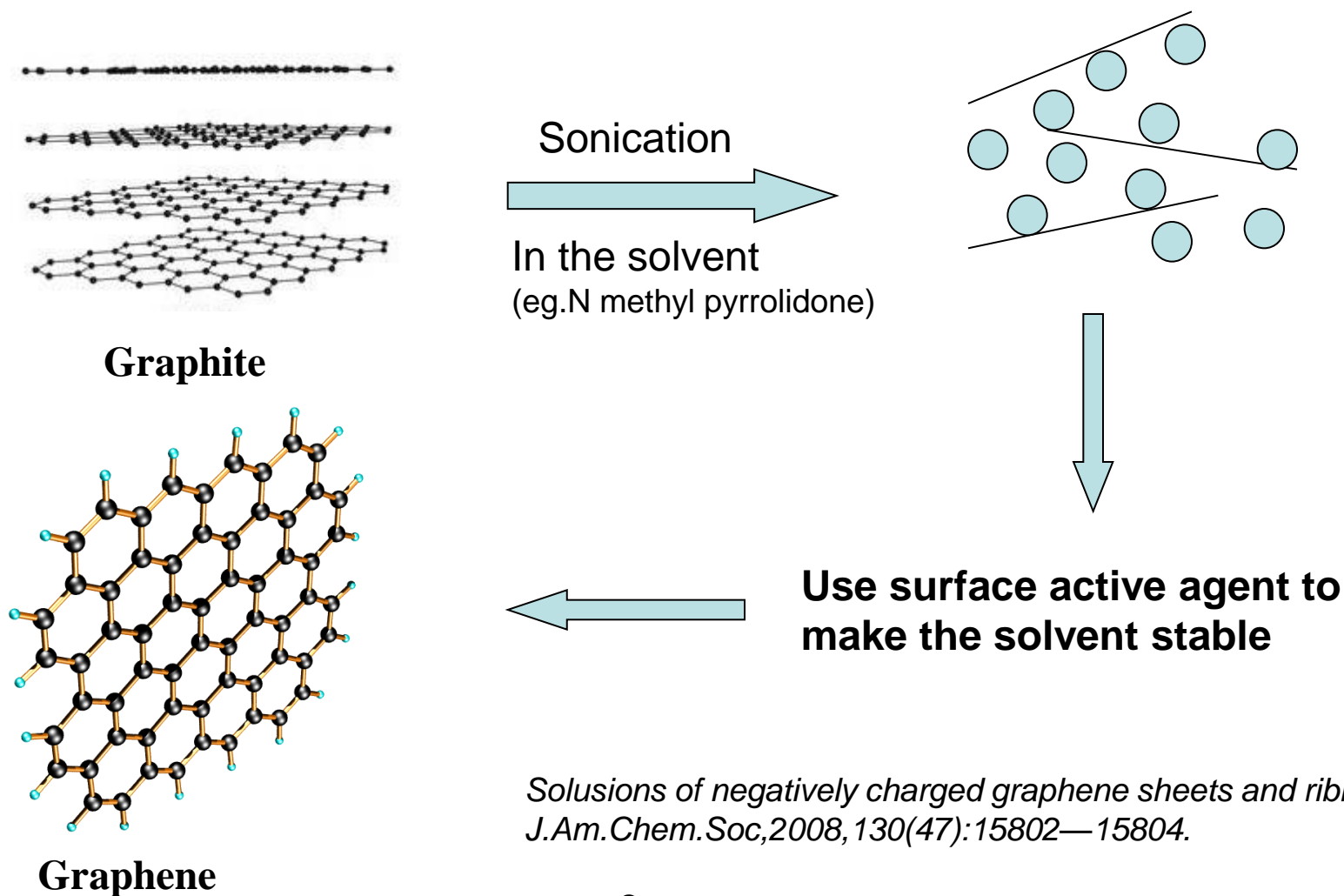
Synthesis Method Of Graphene——Chemical method

2. Oxidation reduction method



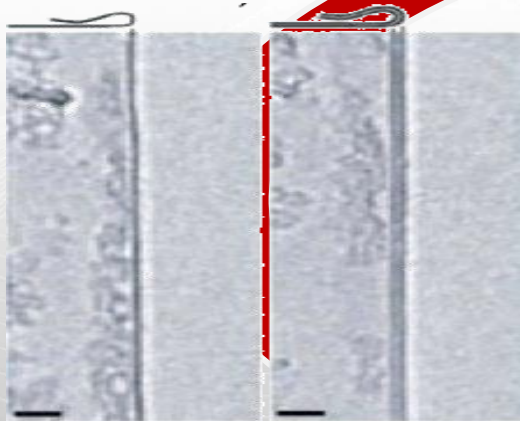
Synthesis Method Of Graphene——Chemical method

3. Solvent stripping method

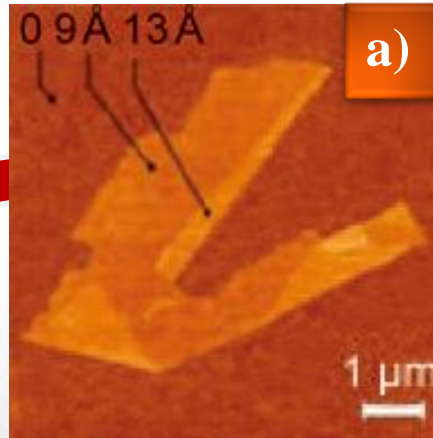


*Solutions of negatively charged graphene sheets and ribbons[J].
J. Am. Chem. Soc., 2008, 130(47): 15802—15804.*

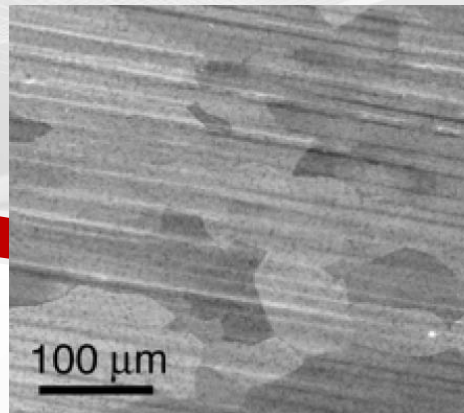
Characterization of graphene



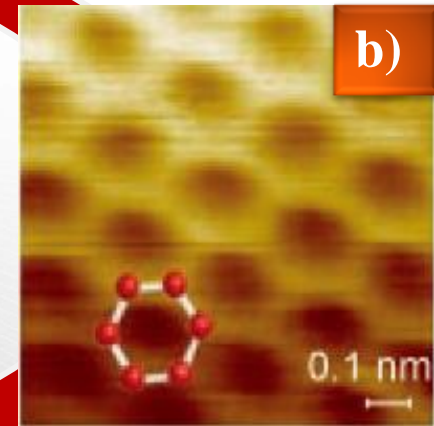
TEM:distinguish the layer structure of graphene.



AFM:distinguish the graphene layers;



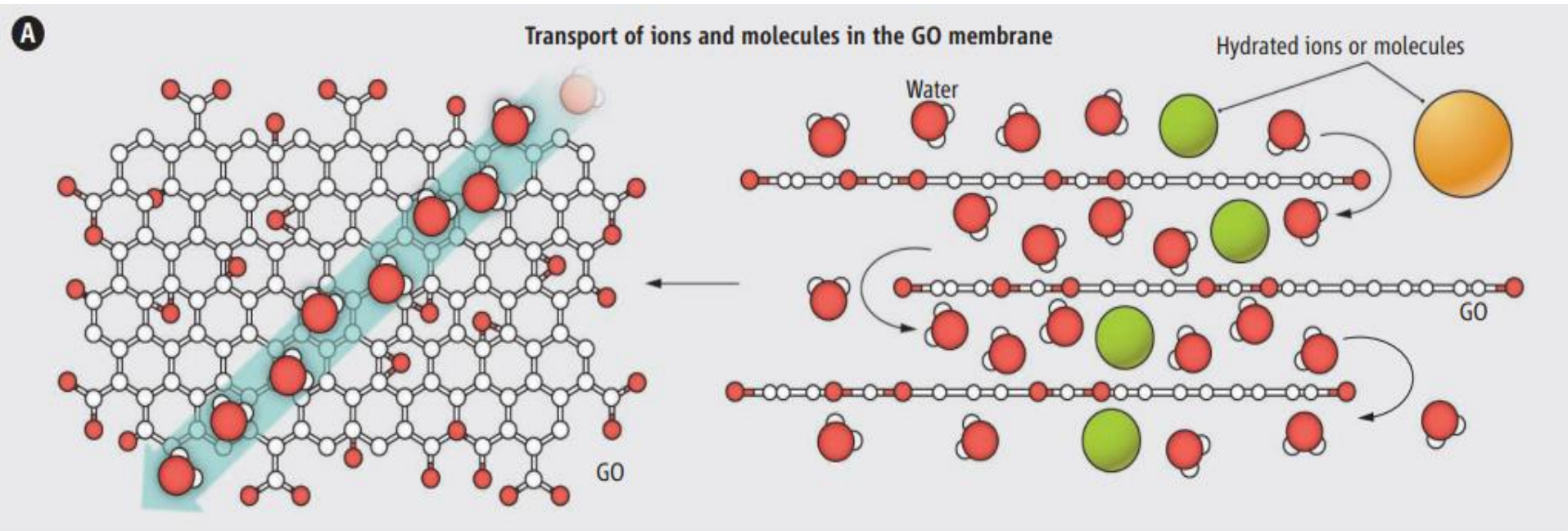
SEM:distinguish the crystal defects



STM: distinguish the crystal structure, but the efficiency is very low.

Reducing Sugar New Functional Molecules for the Green Synthesis of Graphene Nanosheets[J].ACSnano,2010,10:2387-2391.

Research Progress——Graphene Oxide Membranes

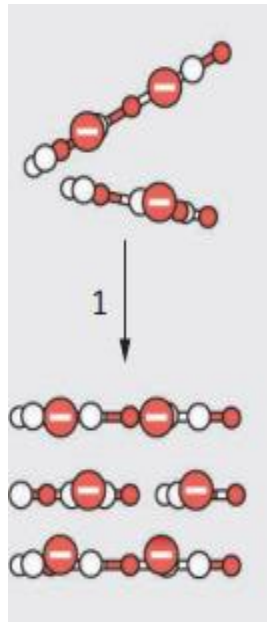


In the layered GO membrane, water molecules permeate through the interconnected nanochannels formed between GO nanosheets and follow a tortuous path primarily over the hydrophobic nonoxidized surface rather than the hydrophilic oxidized region of GO. The nearly frictionless surface of the nonoxidized GO facilitates the extremely fast flow of water molecules.

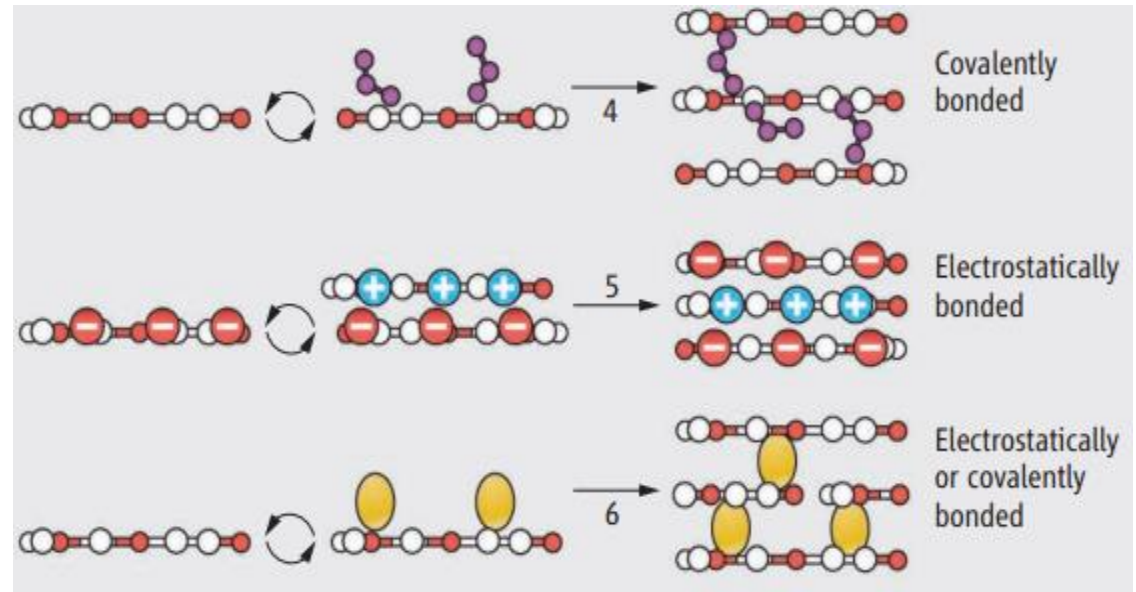
Graphene Oxide Membranes for Ionic and Molecular Sieving. Baoxia Mi, Science 343, 740 (2014).

Research Progress—Graphene Oxide Membranes

The preparation method



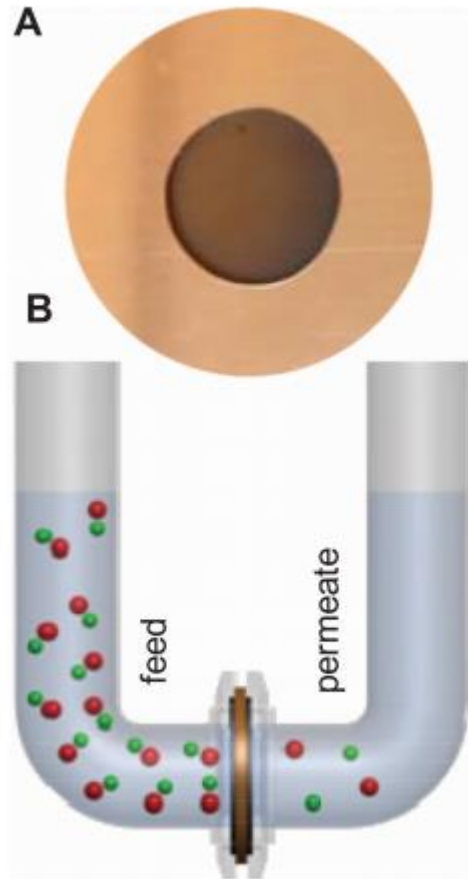
Vacuum filtration



Layer-by-layer assembly

Graphene Oxide Membranes for Ionic and Molecular Sieving. Baoxia Mi, Science 343, 740 (2014);

Research Progress—Graphene Oxide Membranes



(A) A GO membrane covering a 1-cm opening in a copper foil.

(B) A U-shaped tube 2.5 cm in diameter is divided by the GO membrane into two compartments referred to as feed and permeate. Each is filled to a typical level of ~20 cm. Magnetic stirring is used so as to ensure no concentration gradients.

Precise and Ultrafast Molecular Sieving Through Graphene Oxide Membranes.

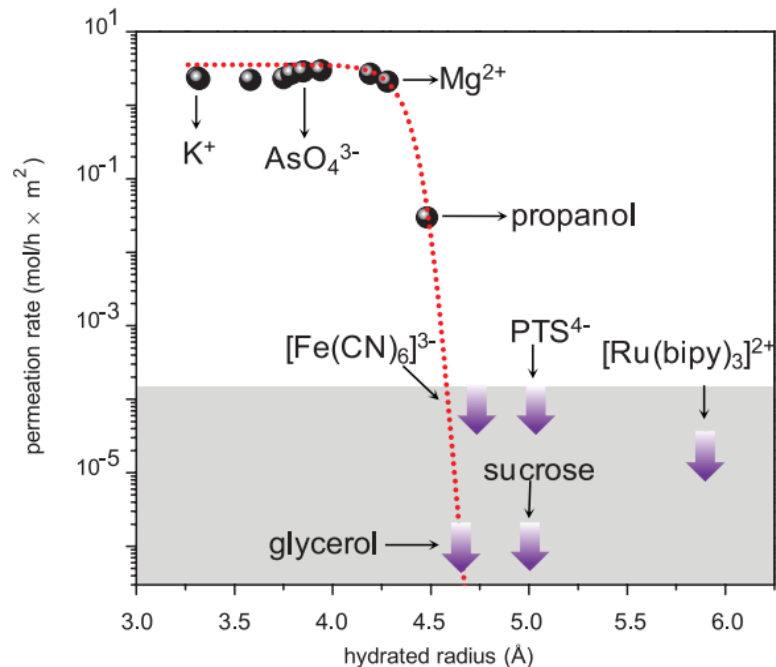
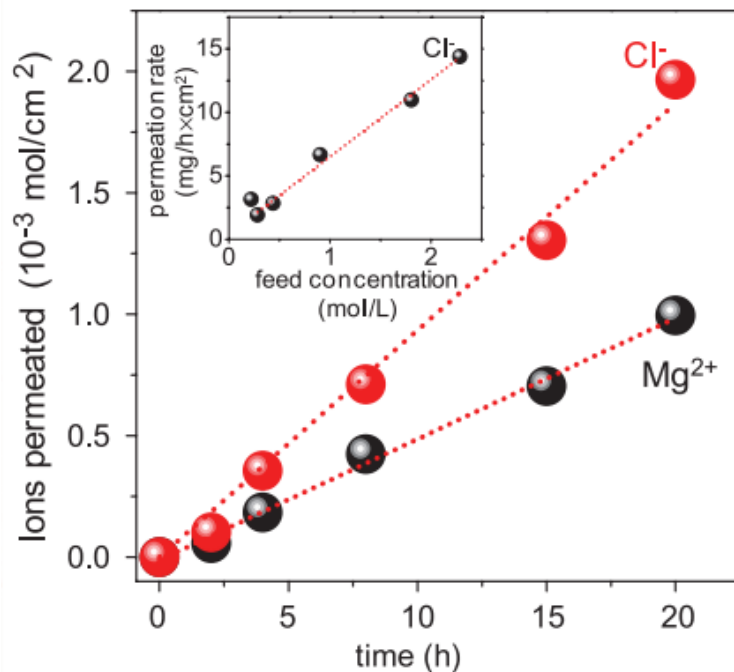
R. K. Joshi et al. Science 343,752 (2014);

Research Progress—Graphene Oxide Membranes

The Properties Of Graphene Oxide Membranes

1. The permeation rates depend linearly on concentration.
2. Cations and anions move through membranes in stoichiometric amounts.
3. The permeation is only decided on ion's hydrated radius.
4. The permeation rates do not depend on ion charge.
5. Water is necessary during the permeation process.

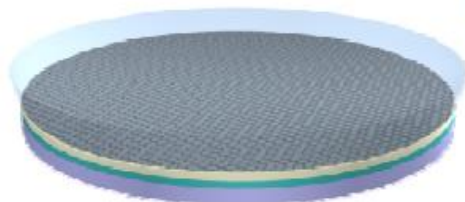
c



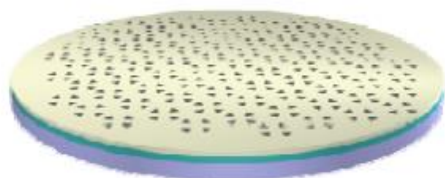
Research Progress——wafer-scale graphene films

➤ SAMSUNG

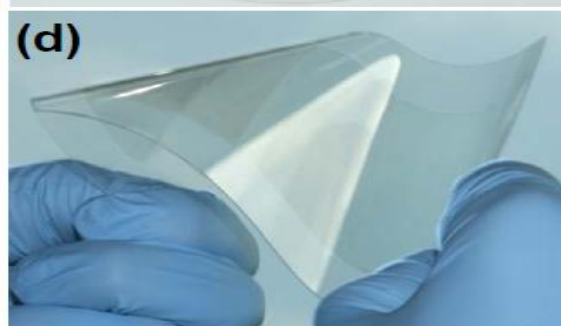
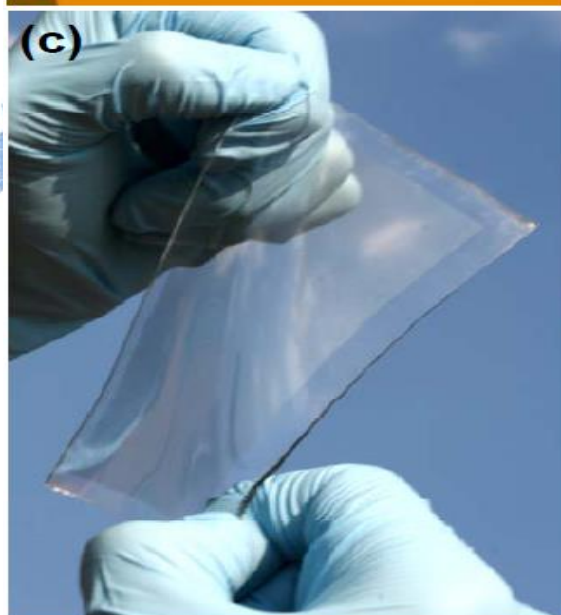
Support/Graphene/**Ni(or Cu)**/SiO₂ peel in



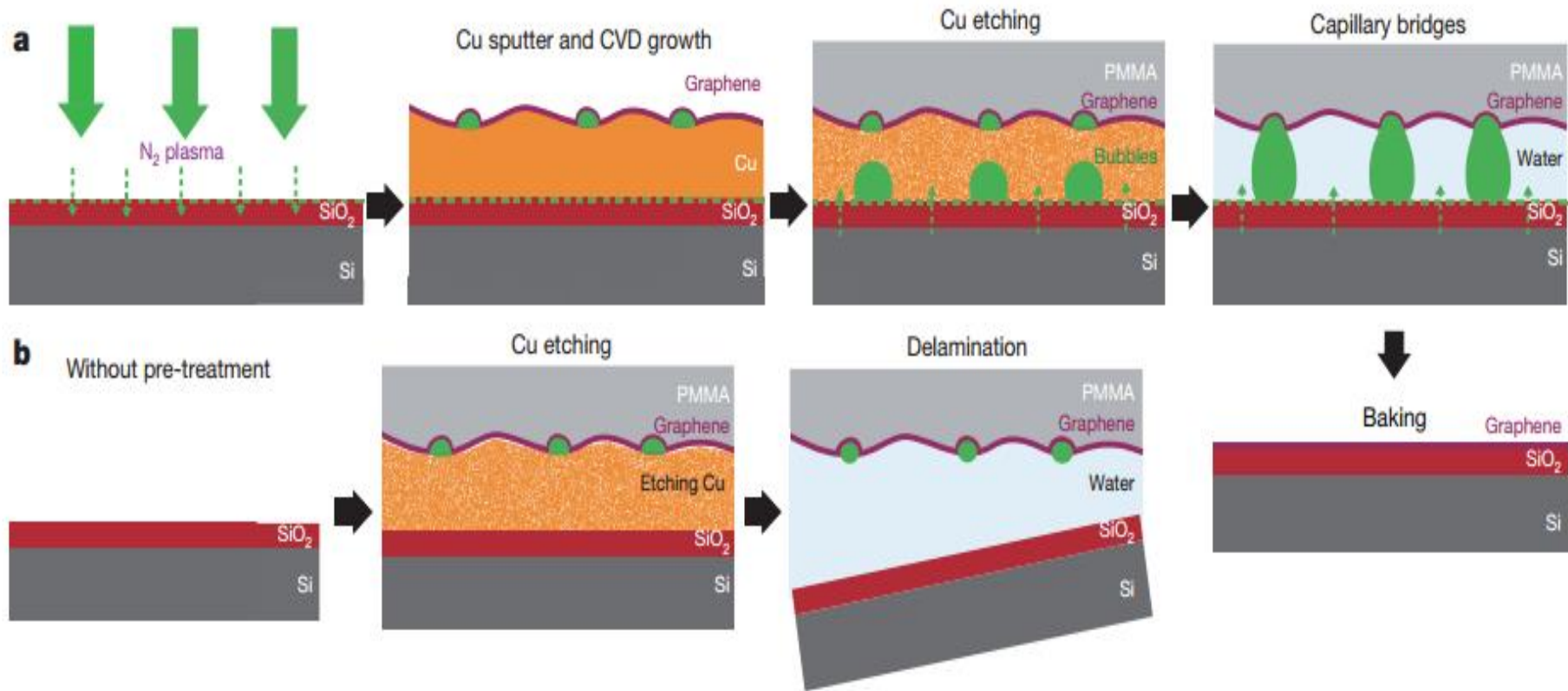
➡ Post-patterning
➡ Pre-patterning



Patterned graphene on Ni



Research Progress——wafer-scale graphene films

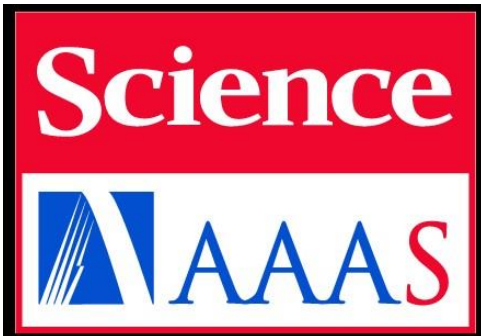


*Face-to-face transfer of wafer-scale graphene films.
Libo Gao et al. Nature 2014.505:190-194*

Future research directions

New synthetic method of graphene.

New synthetic method of graphene oxide membranes and find more application of GO(eg. In desalination, biomedical and pharmaceutical fields).



The honor belongs to whom

Acknowledge

Thank you for Prof.Zhao

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