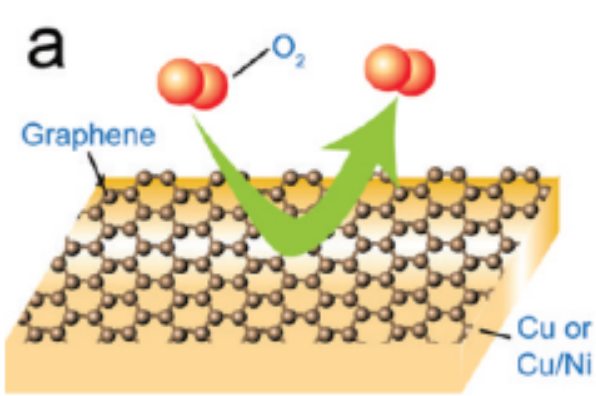
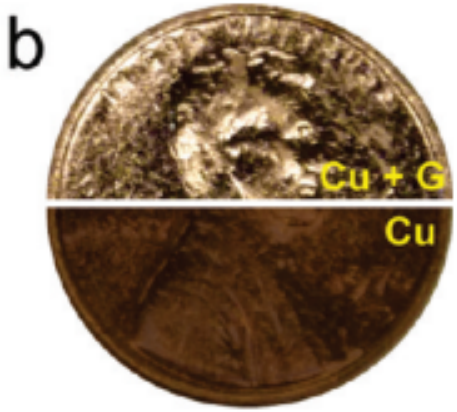
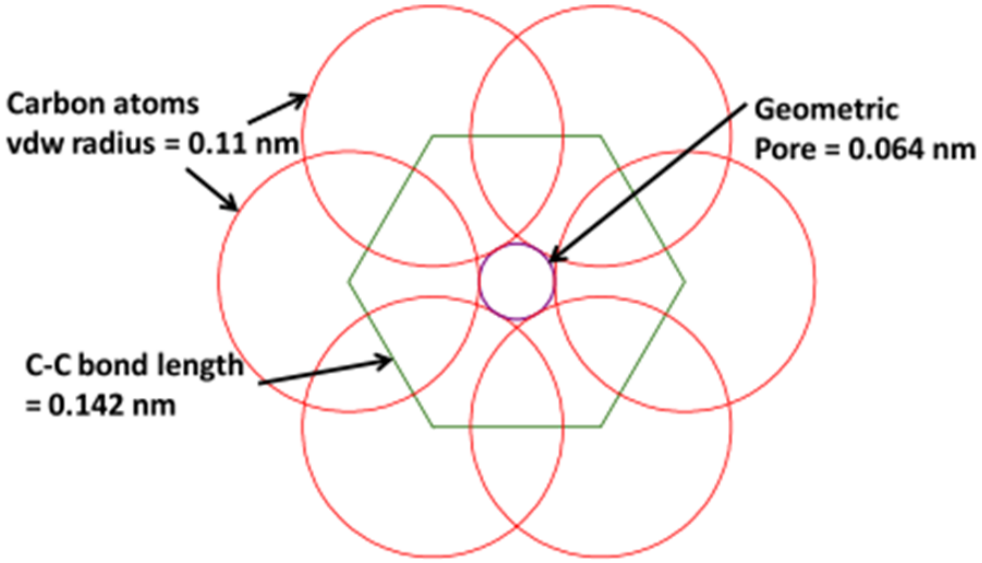
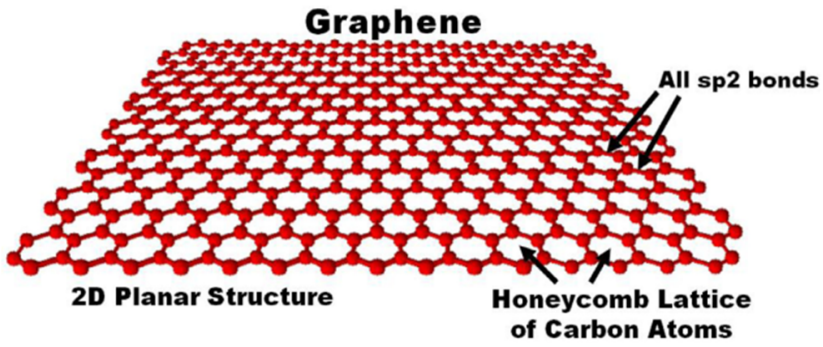
Protective properties of graphene









DOI 10.1021/nn203507y

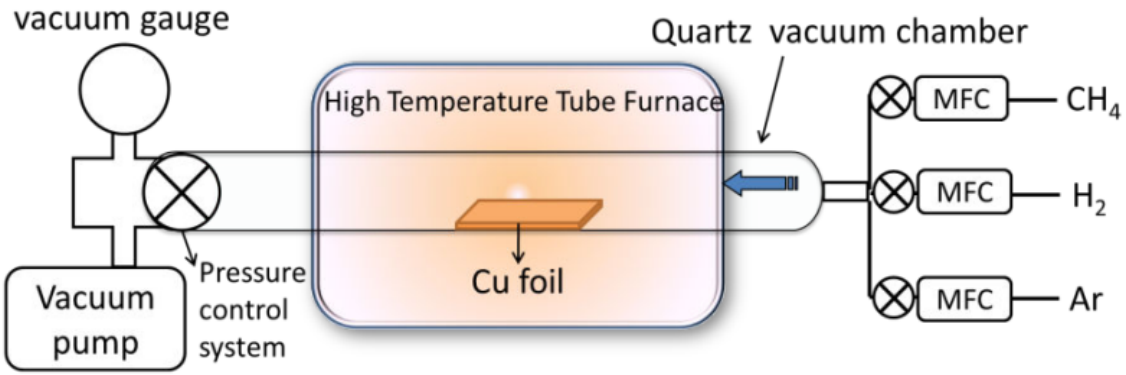
DOI: 10.1016/j.carbon.2013.05.052

Types of CVD

1. Atmospheric Pressure CVD

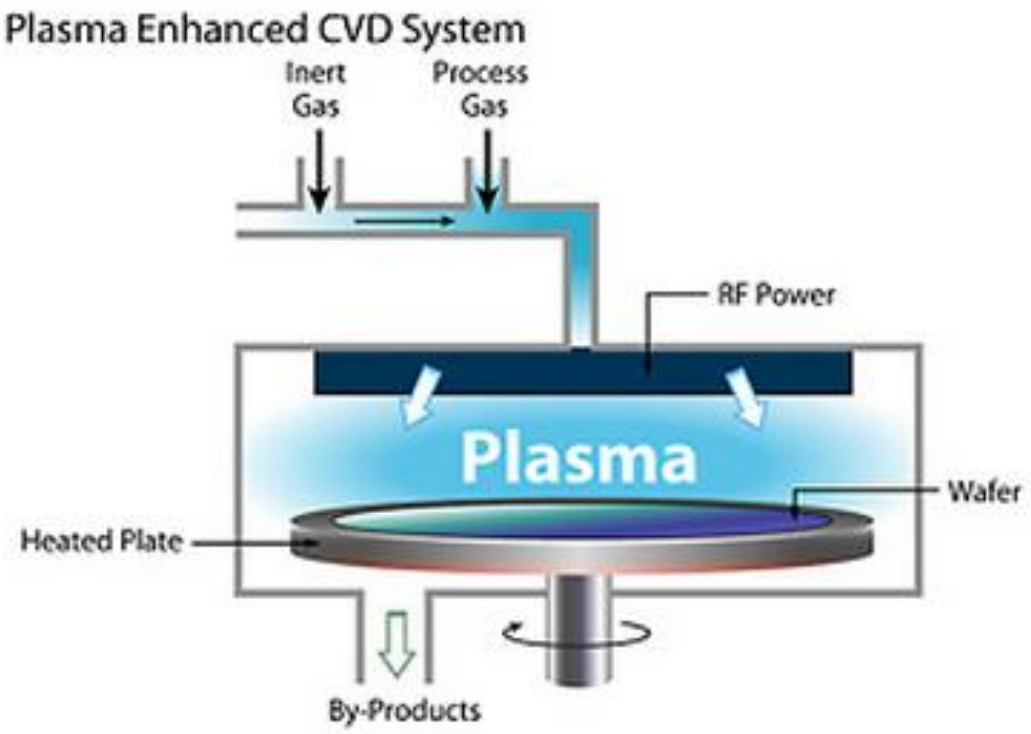
2. Low Pressure CVD
 -Plasma Enhanced CVD
 -Photochemical Vapour Deposition
 -Thermal CVD

Scheme of CVD setup

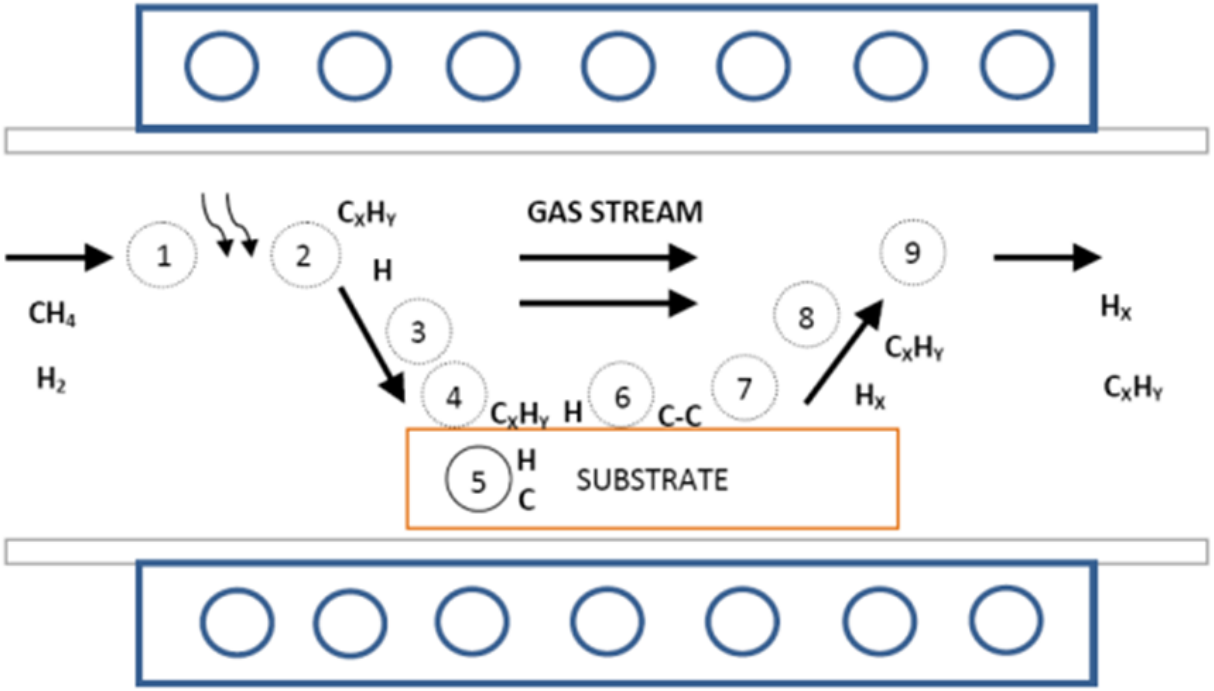


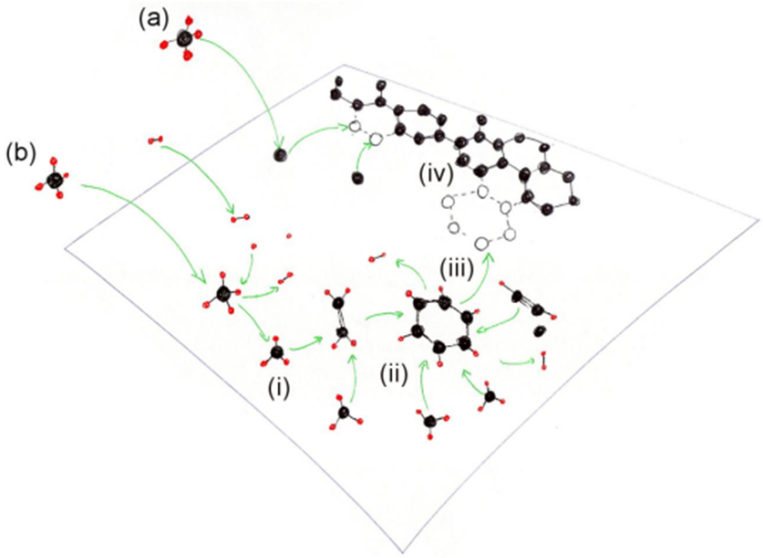
Temperature range	**400 -1200 C**
Pressure range	**atmospheric – UHV (~10-8 Torr)**
Precursors	**gases, liquids, solids**
Substrates	**SiC, Transition metals**

Plasma-assisted CVD



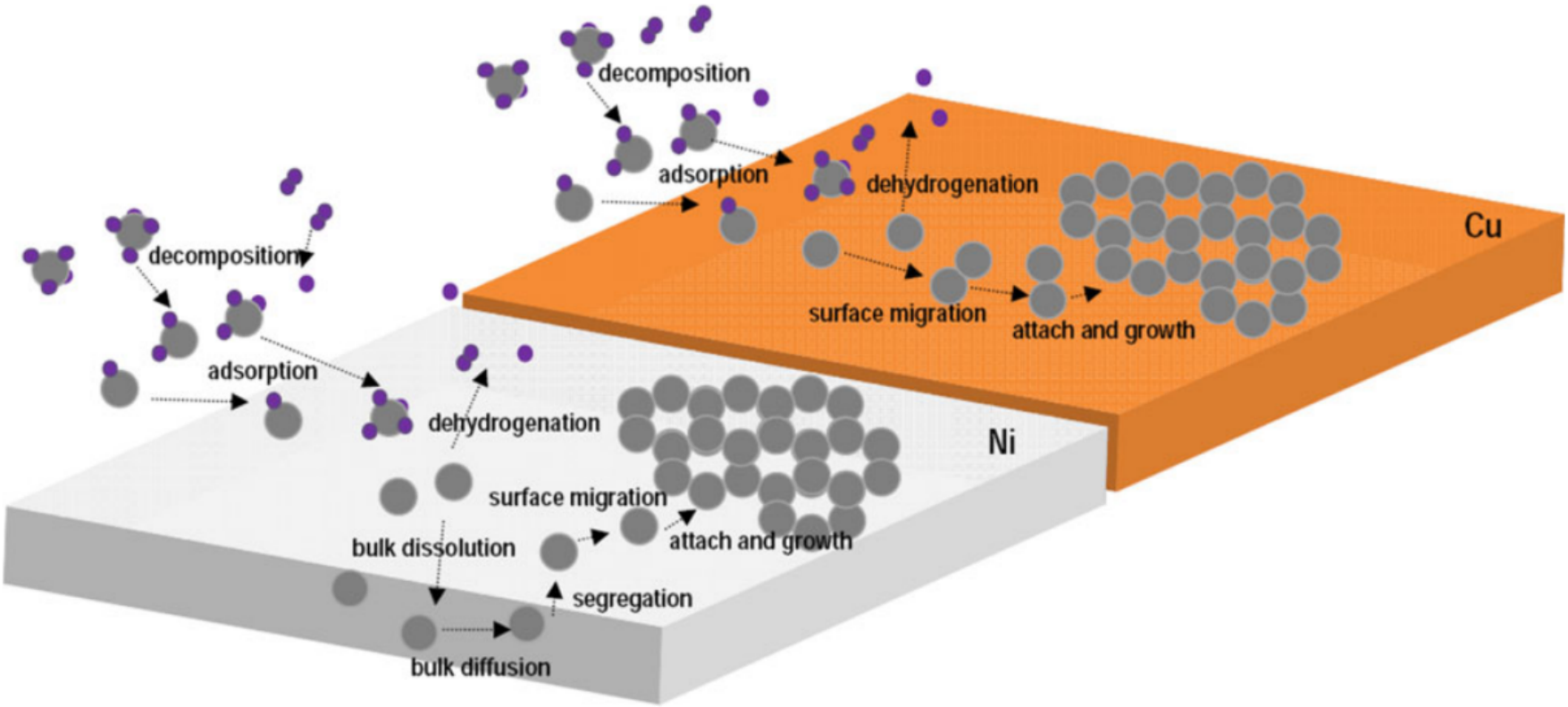
Steps involved in CVD process





DOI: 10.1002/cvde.201300051

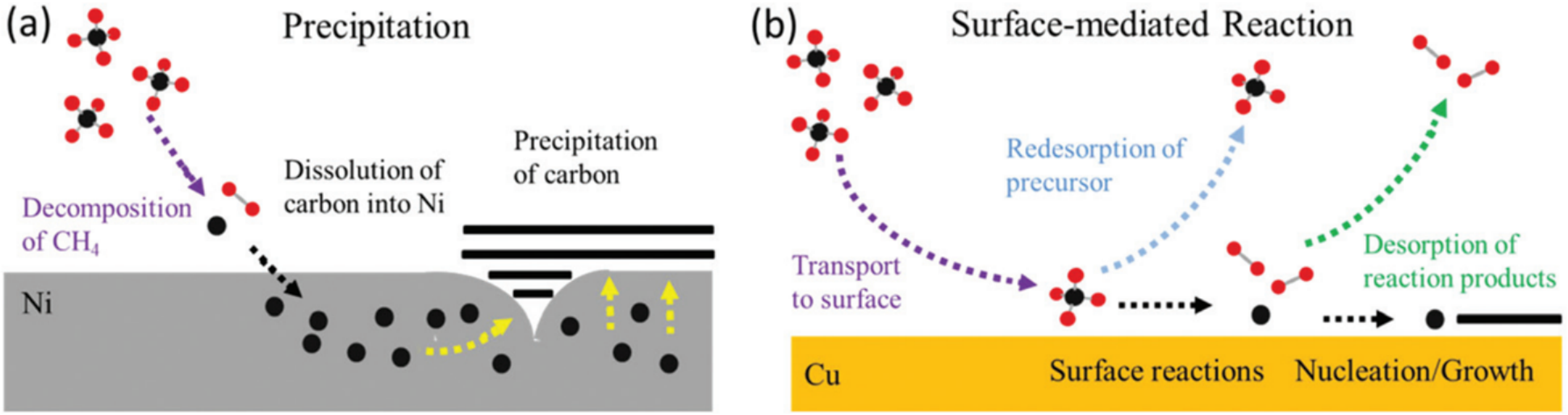
Mechanisms of graphene growth

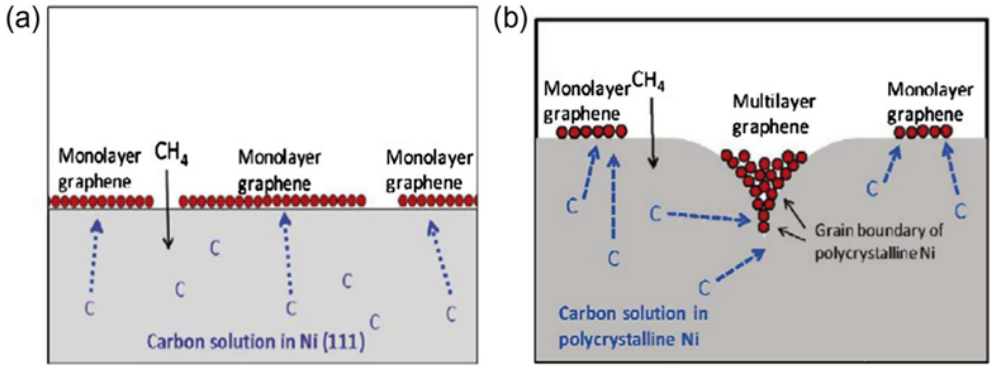


Growth kinetics in CVD-produced graphene on various catalysts: Case of CH4 on Ni and Cu

DOI: 10.1016/j.carbon.2013.12.073

Mechanisms of graphene growth

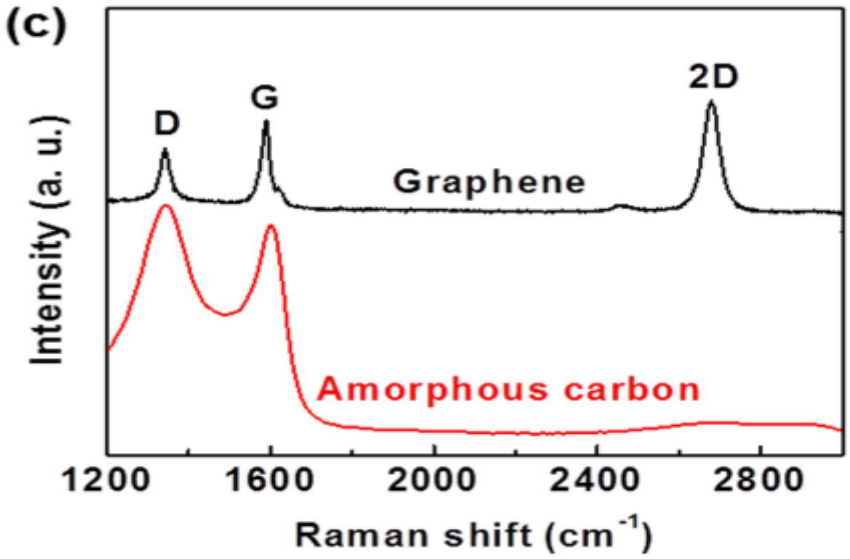


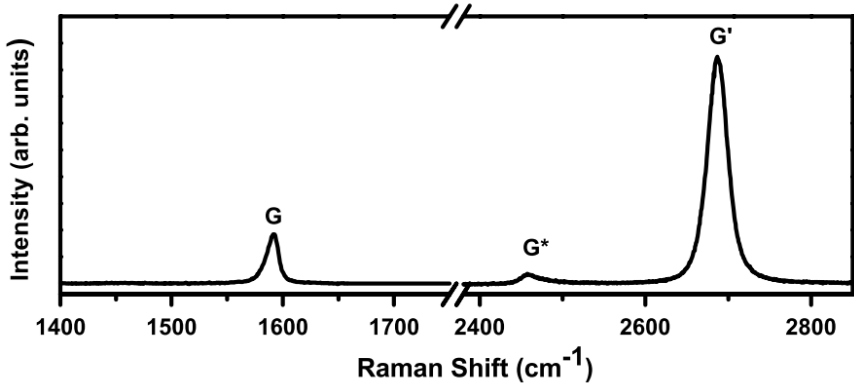


Graphene formation on (a) a single-crystal Ni(111) surface and (b) a polycrystalline Ni surface

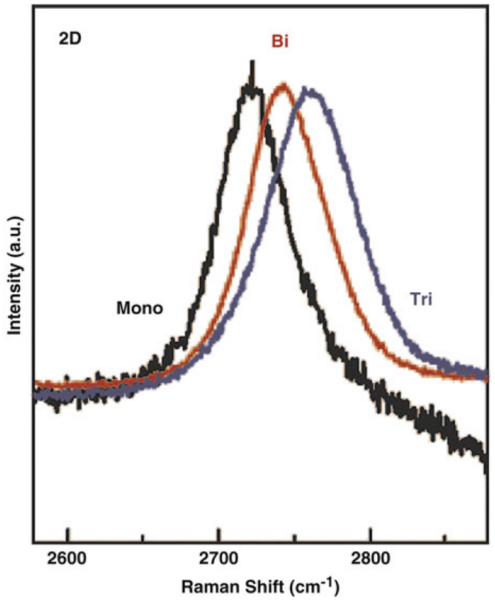
DOI: 10.1039/C5NR04756K

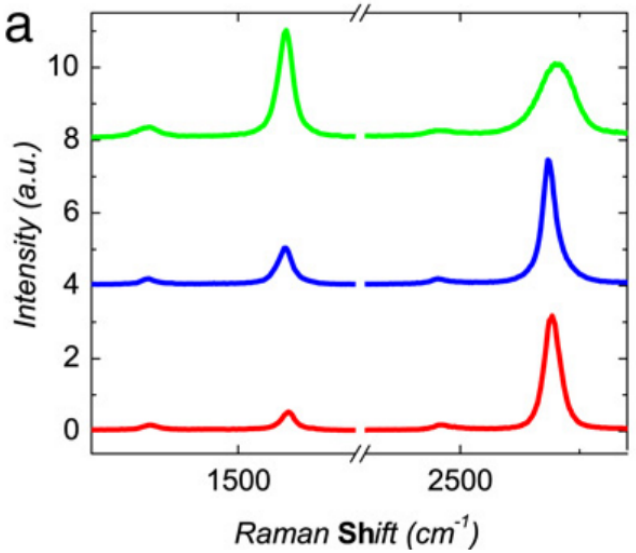
Graphene characterisation by Raman spectroscopy





Typical Raman spectra of single layer of Graphene

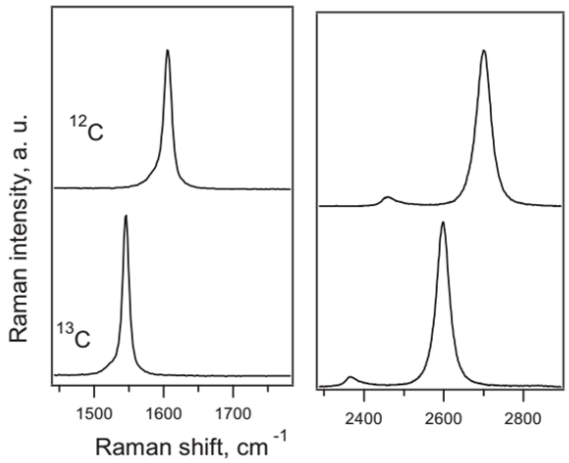




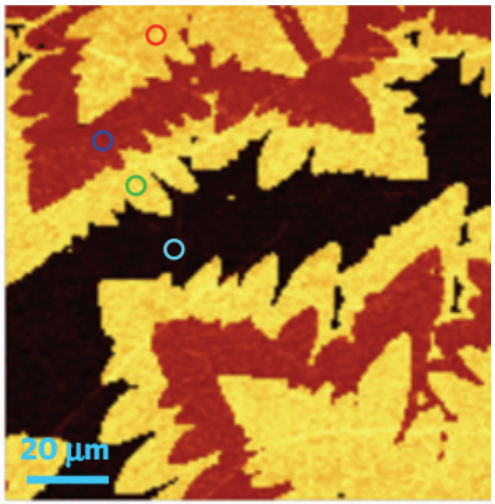
DOI: 10.1038/srep17955

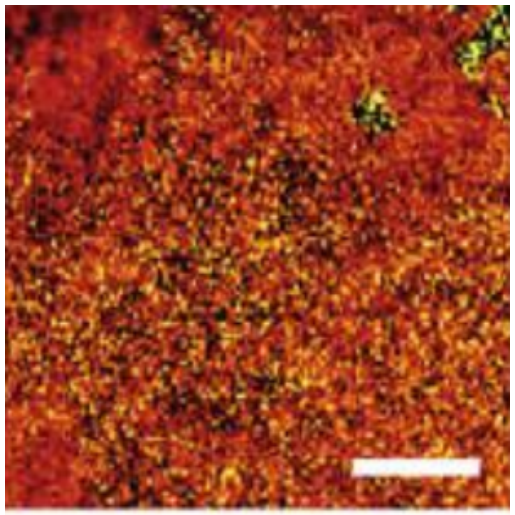
Isotopic labelling of the carbon precursor

DOI: 10.1021/nl902515k

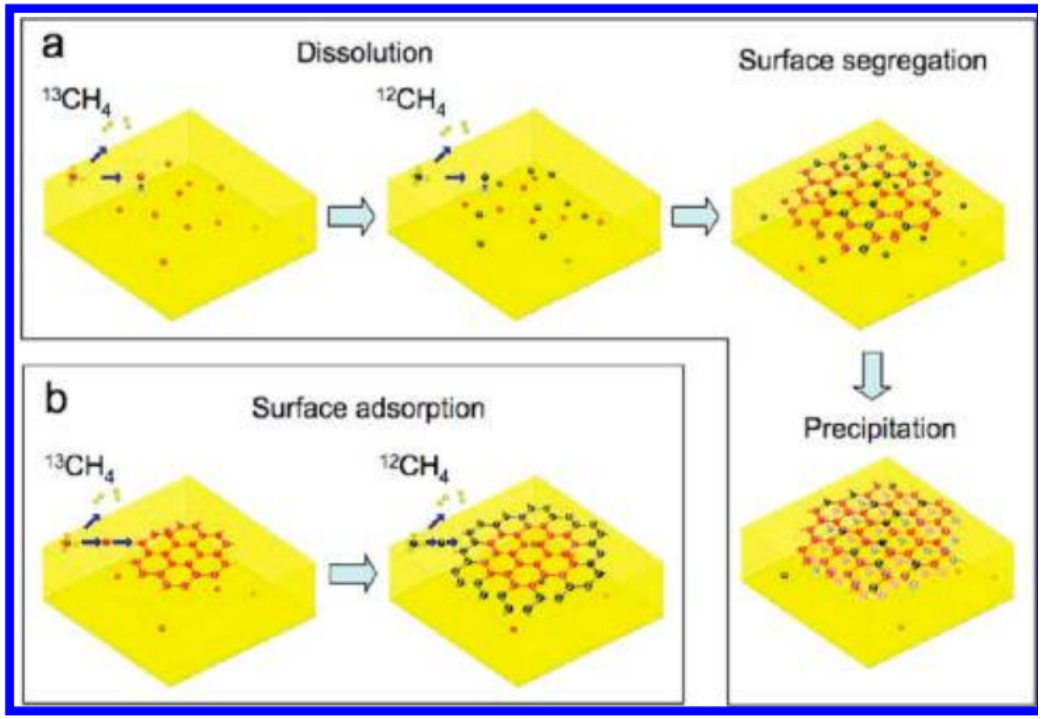


Raman shift difference between carbon isotopes

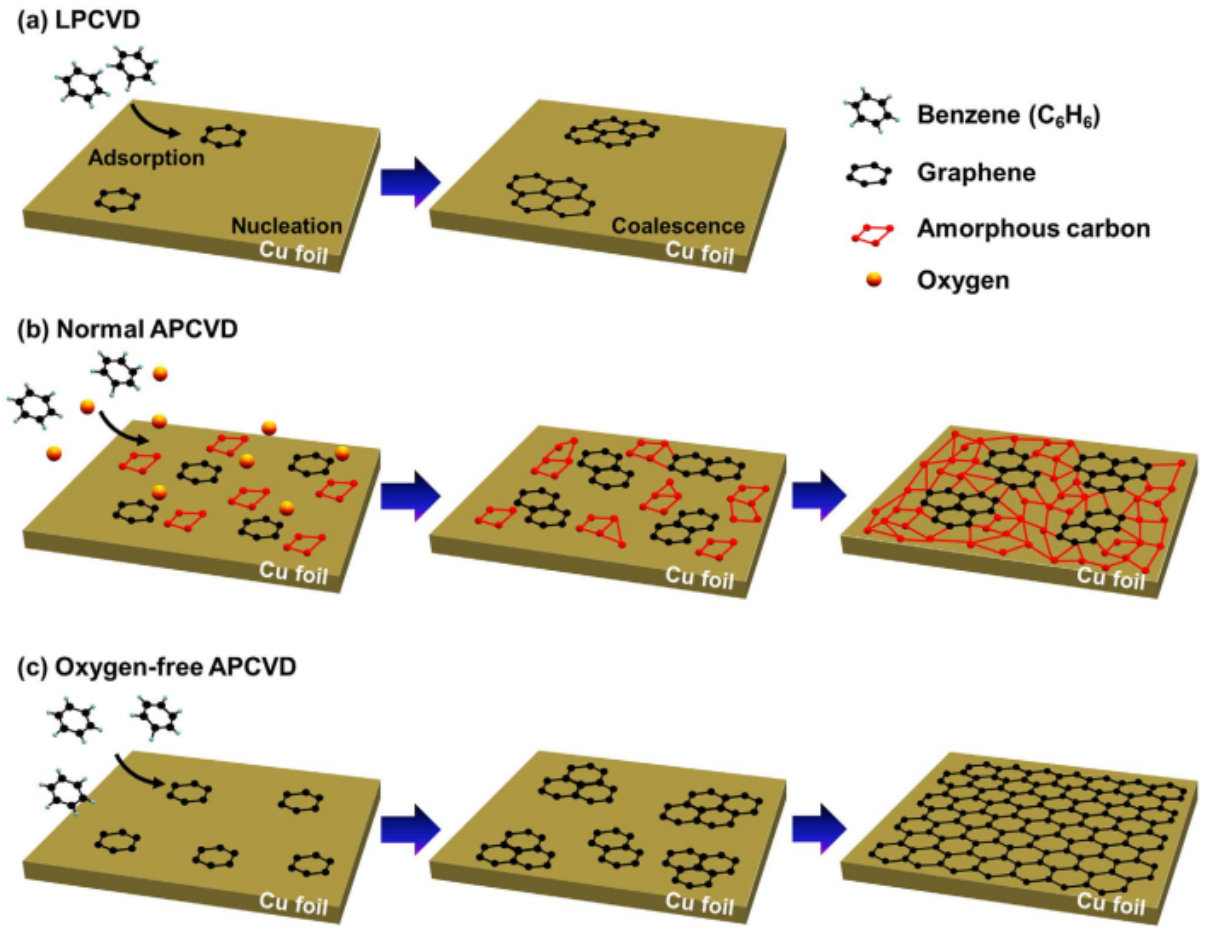




Raman mapping of graphene grown on Cu and Ni

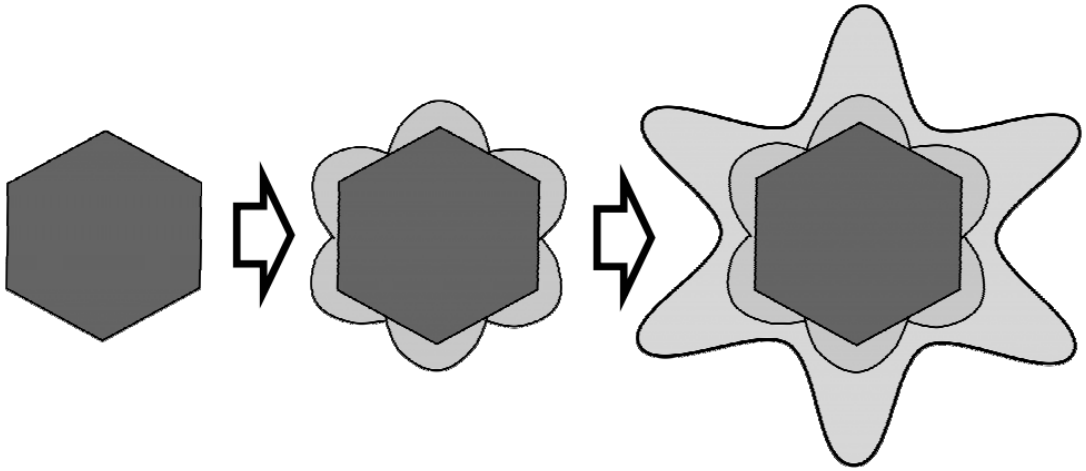


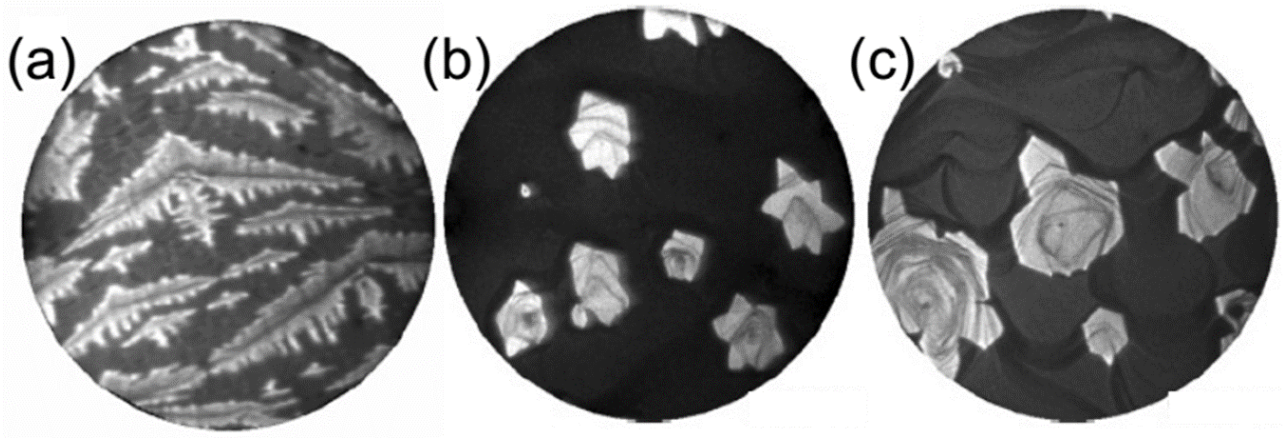
How does graphene grow



DOI: 10.1038/srep17955

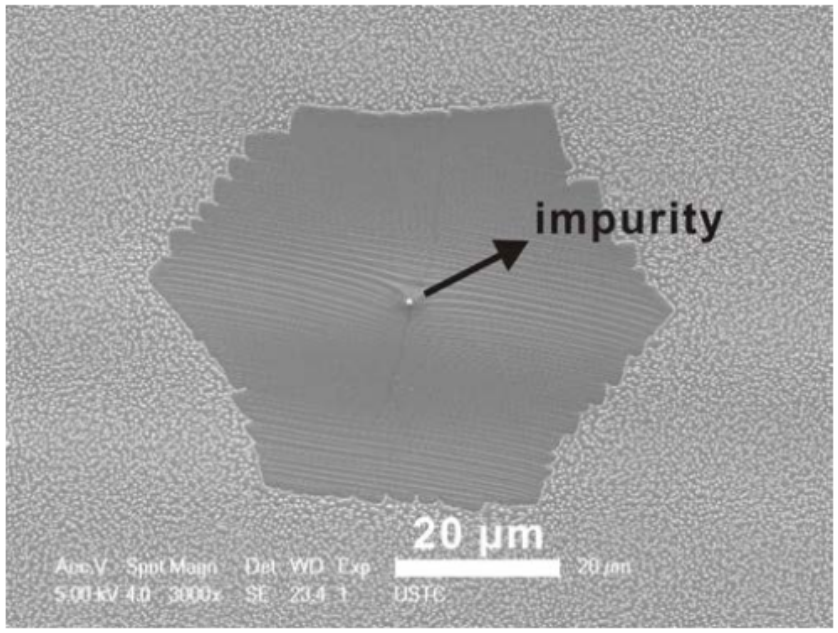
Evolution of graphene shapes

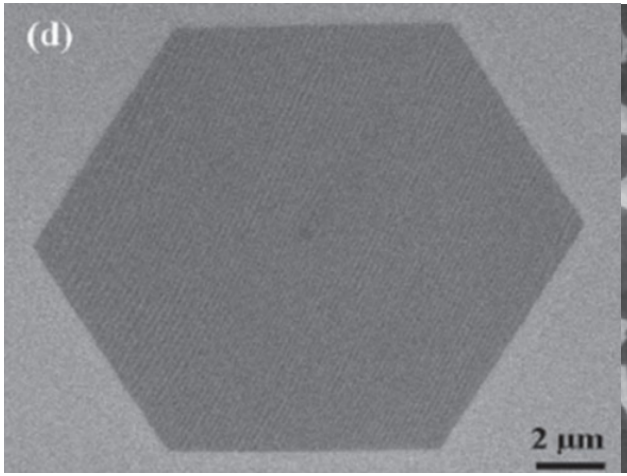


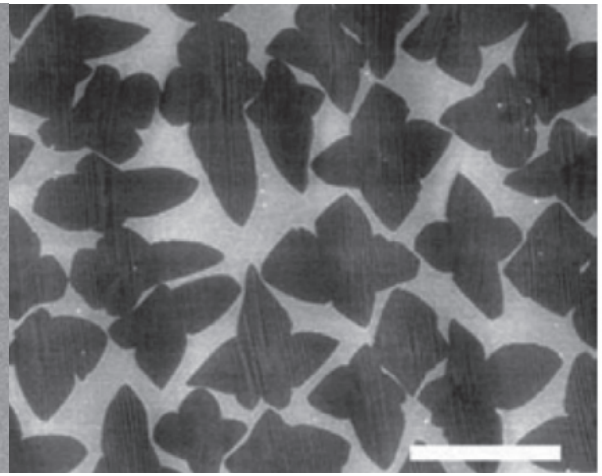


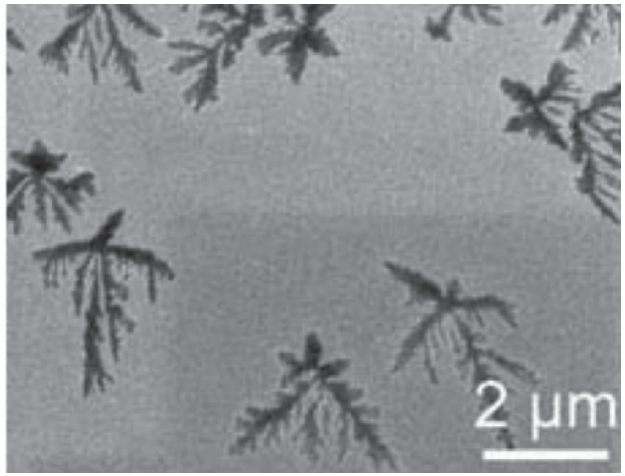
Temperature dependency of graphene growth

Variety of graphene shapes

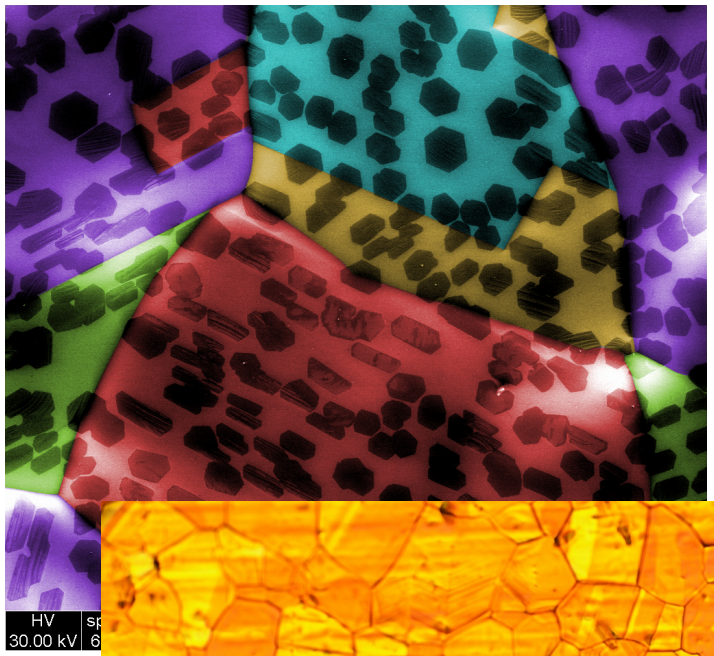


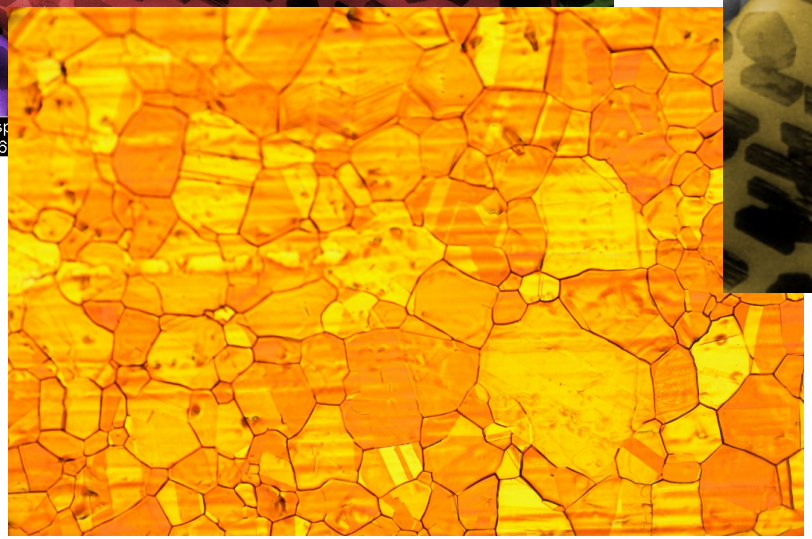


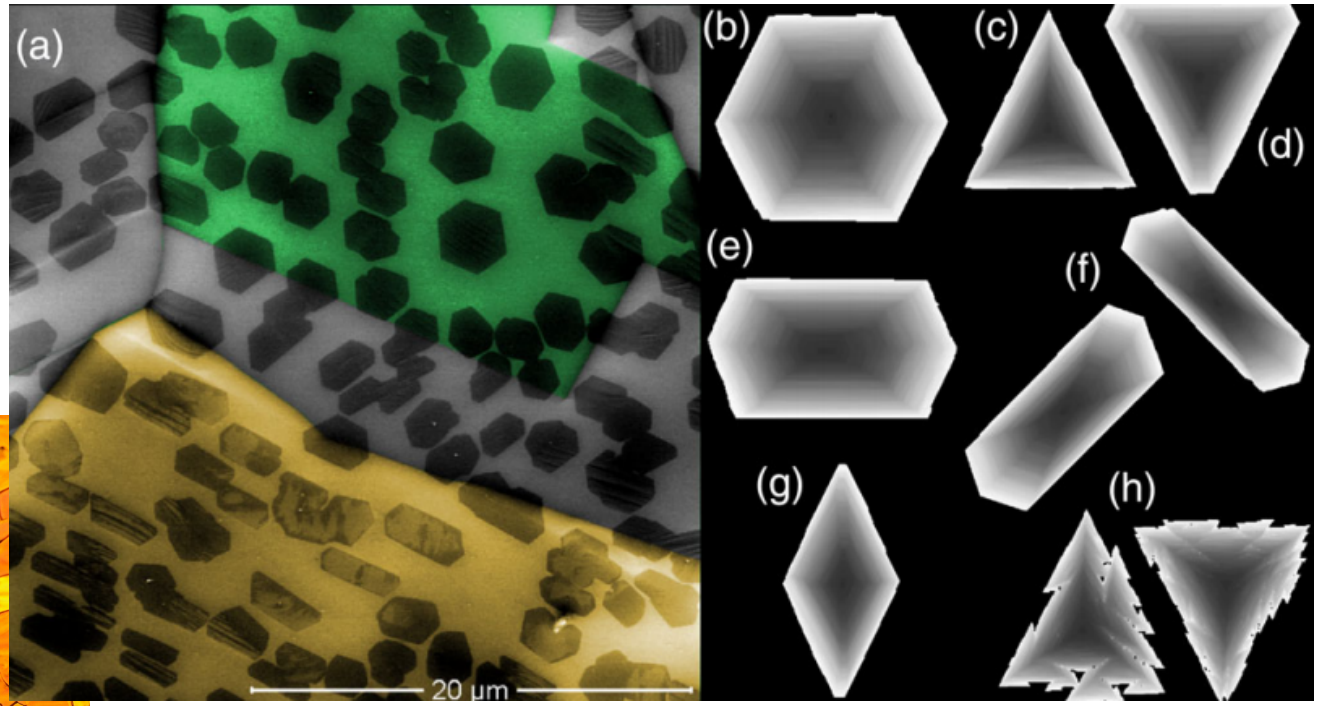




Copper polycrystalline and shape of graphene flakes

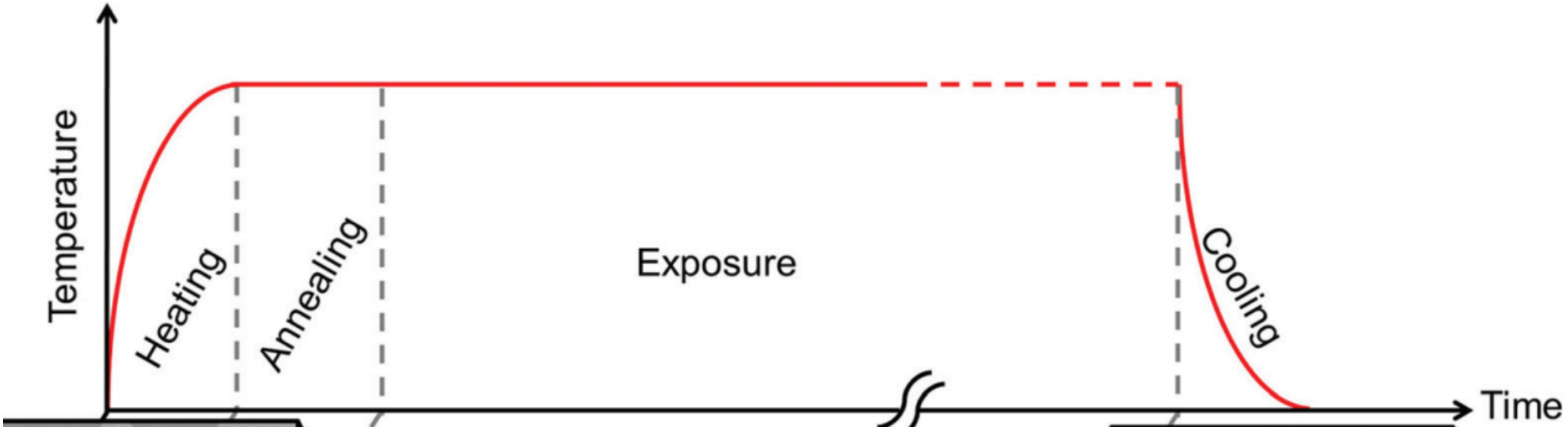




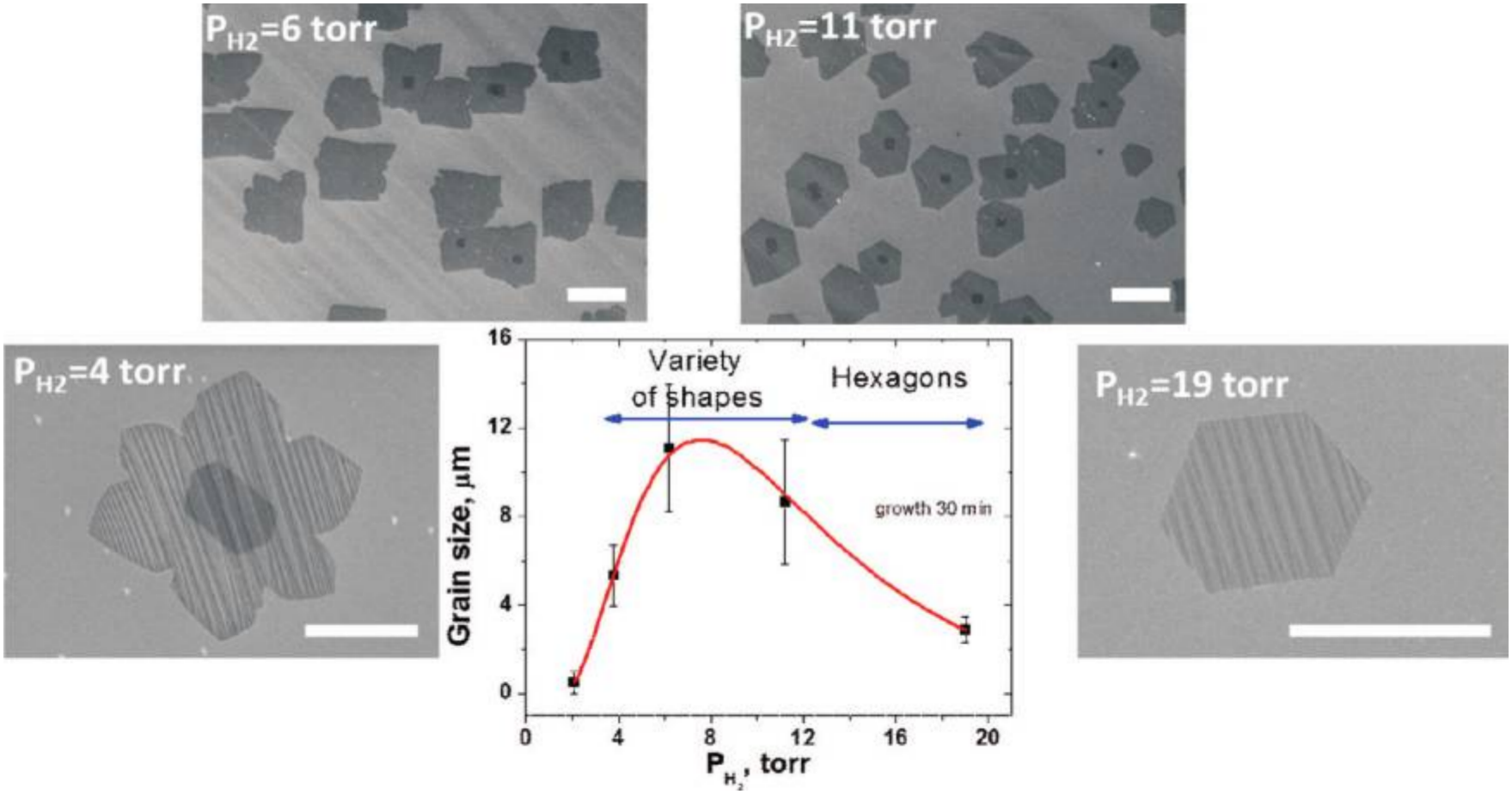


DOI:http://dx.doi.org/10.1103/PhysRevLett.114.115502

Schematic diagram of graphene growth

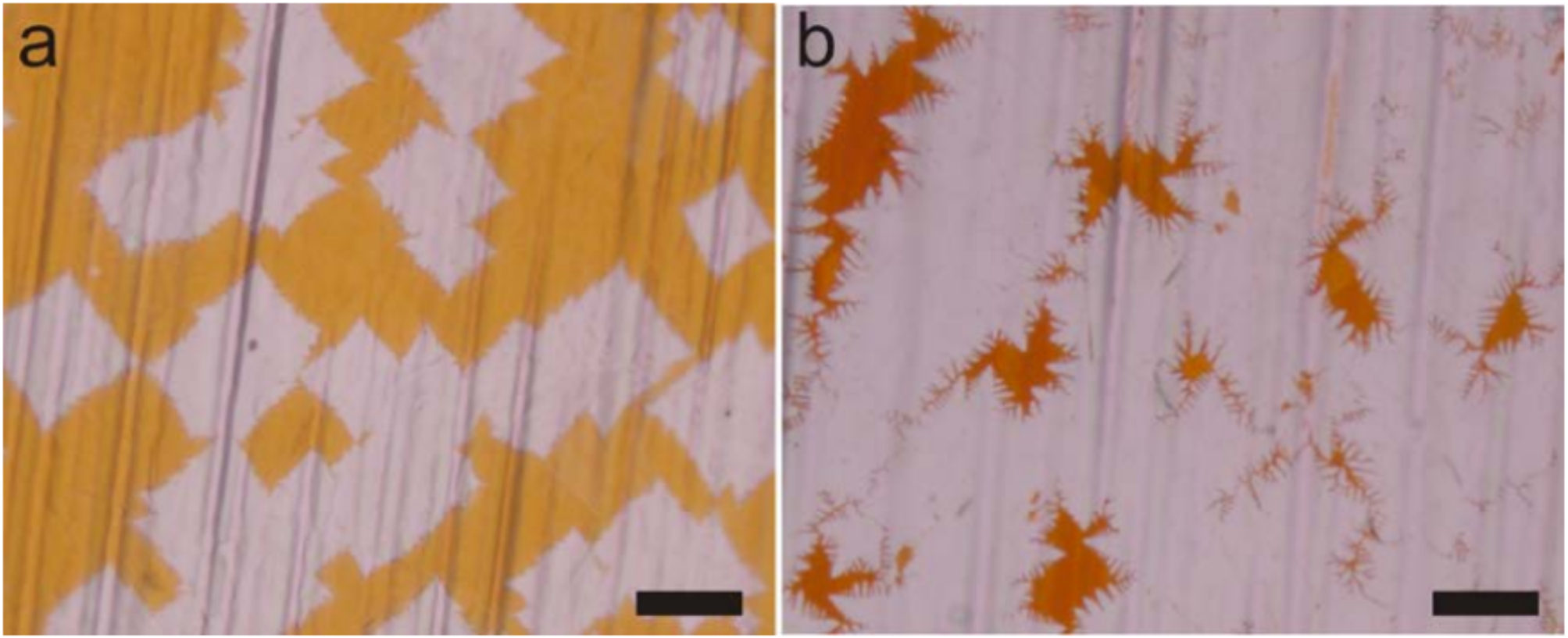


Role of hydrogen in graphene formation



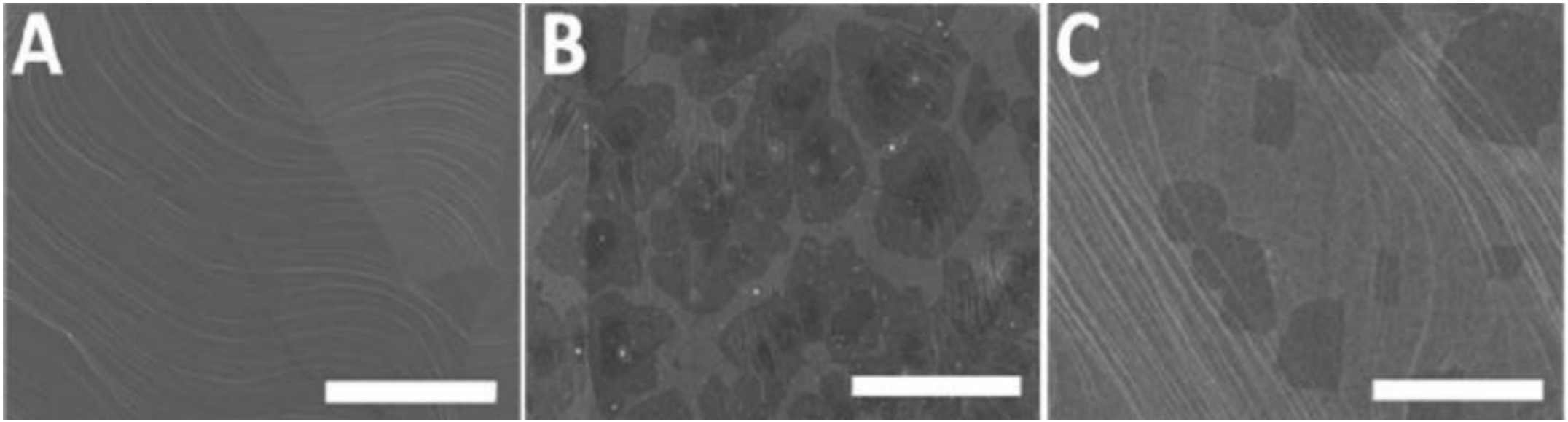
DOI: 10.1021/nn201978y

Role of hydrogen in graphene formation



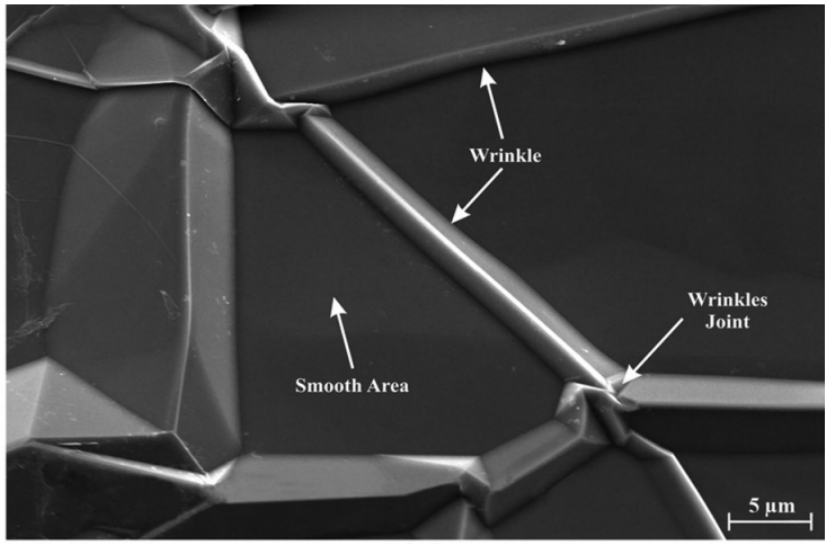
DOI: 10.1021/nn201978y

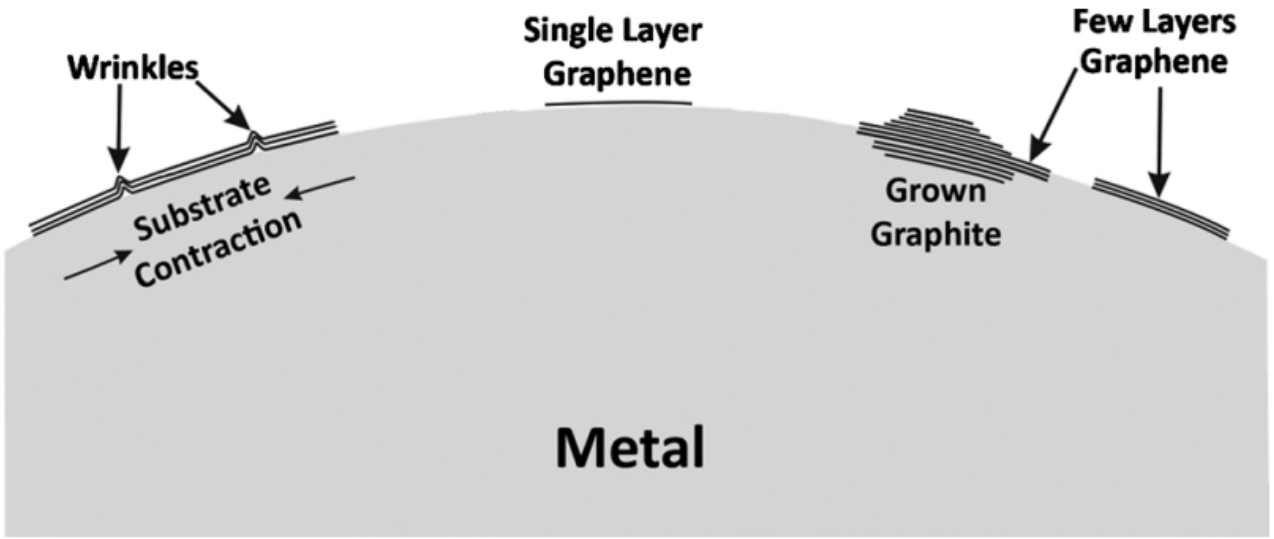
Influence of methane



DOI: 10.1021/nn201978y

Defects in graphene

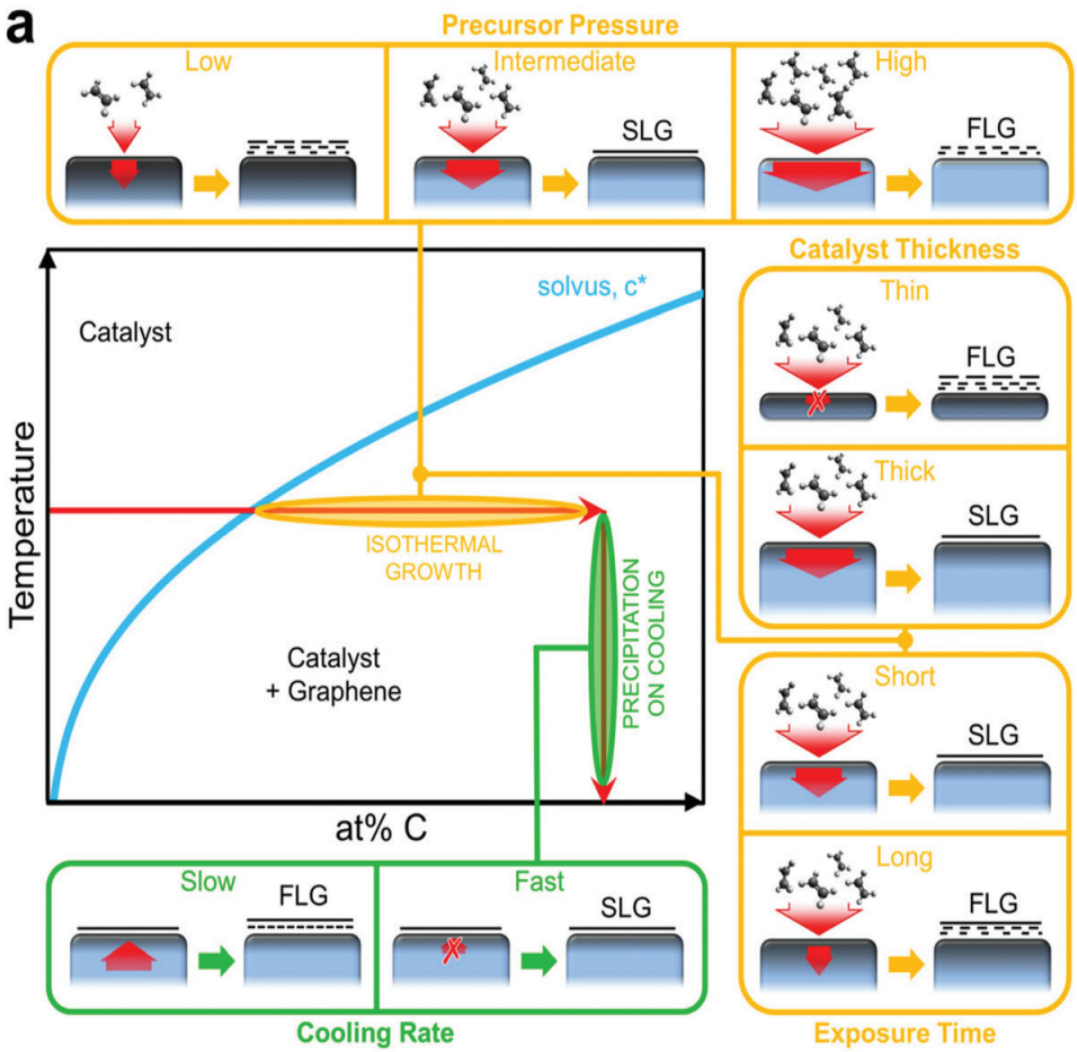


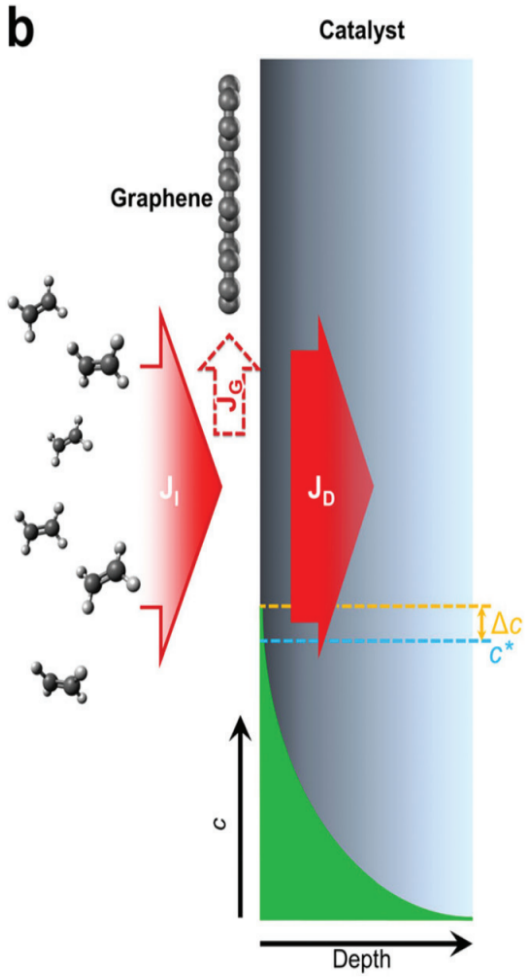


Schematic of wrinkle, SLG and a FLG formation

doi:10.1063/1.3498815

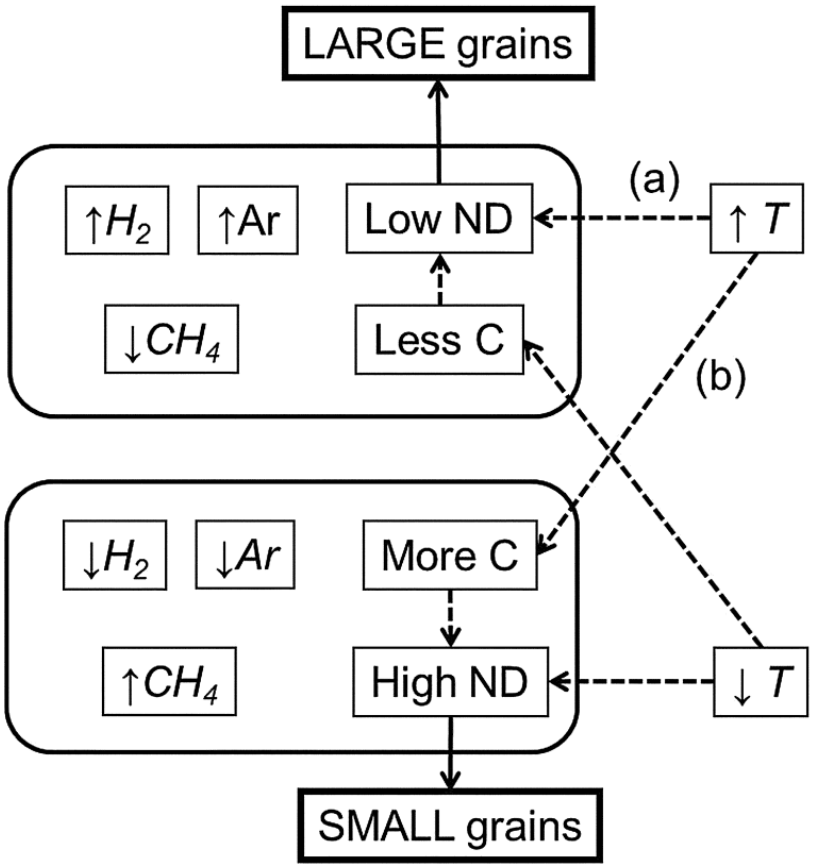
Two possible routes for graphene growth



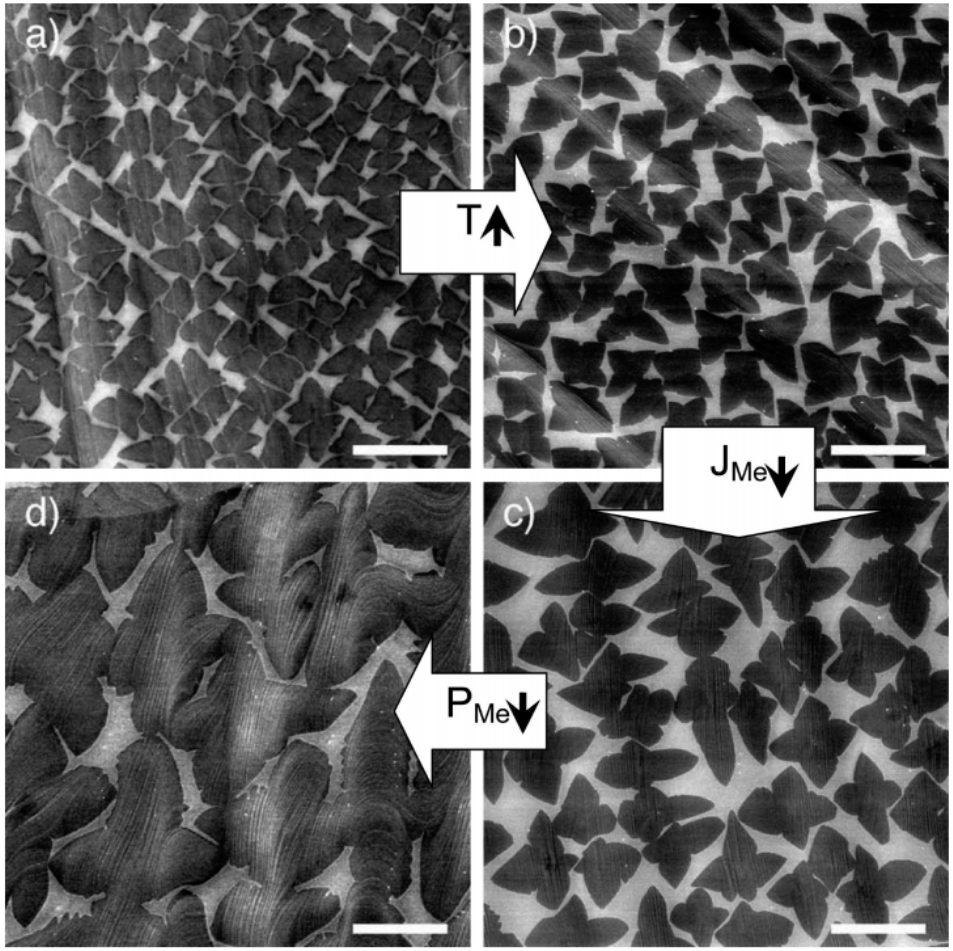


DOI: 10.1039/C5NR06873H

The “prediction table” of graphene growth

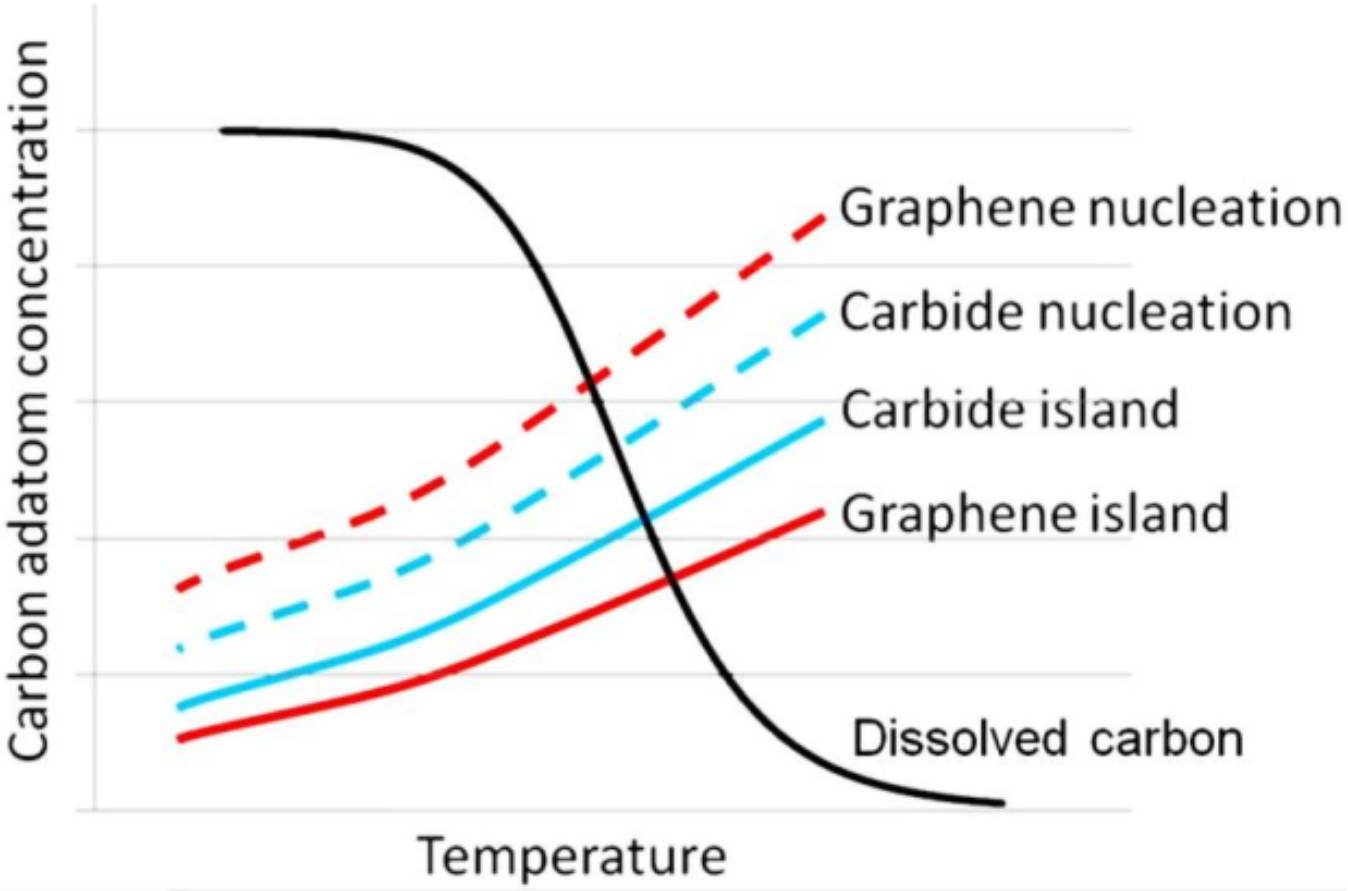


DOI: 10.1002/cvde.201507163

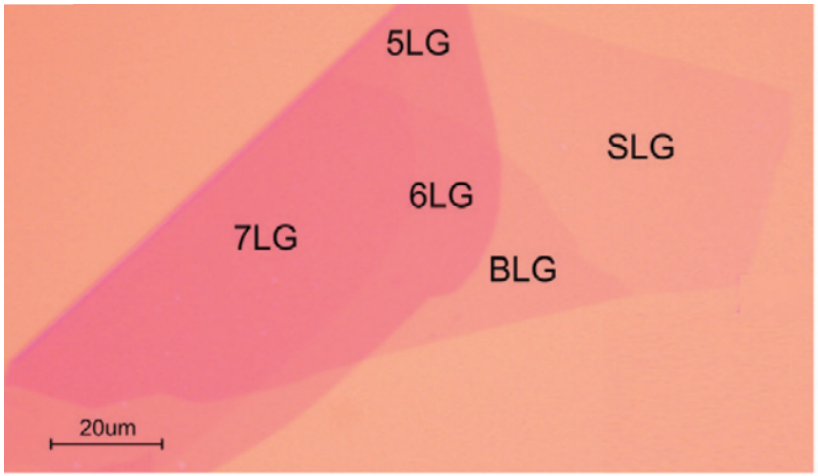


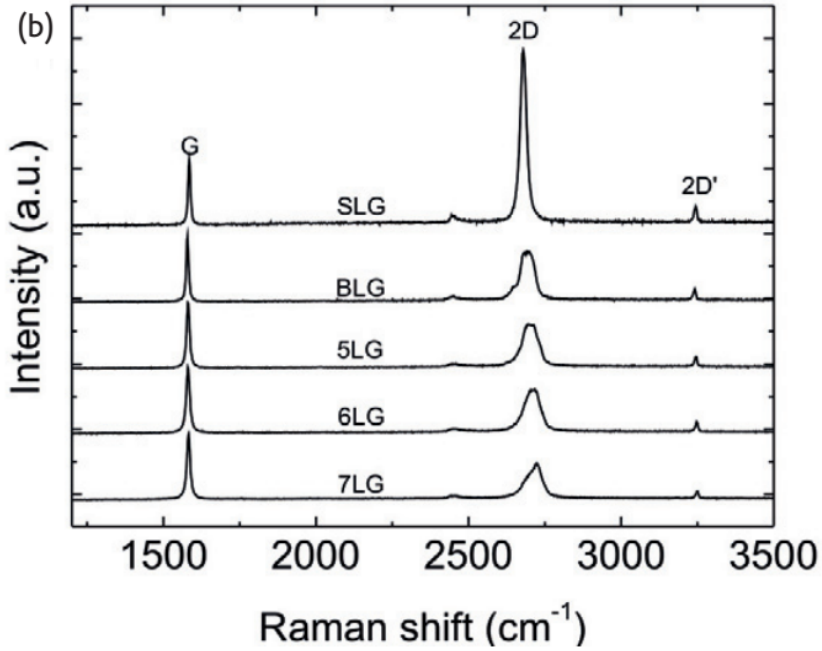
SEM images of partially grown graphene under different growth conditions

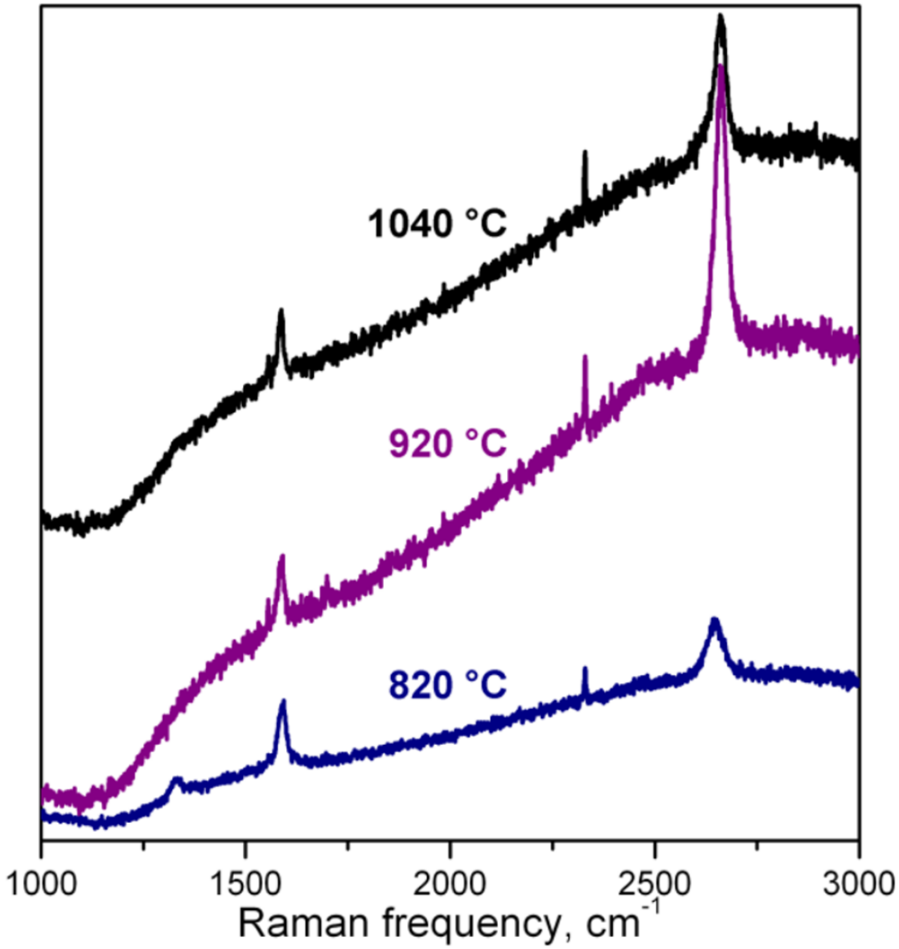
Mechanism of carbide forming

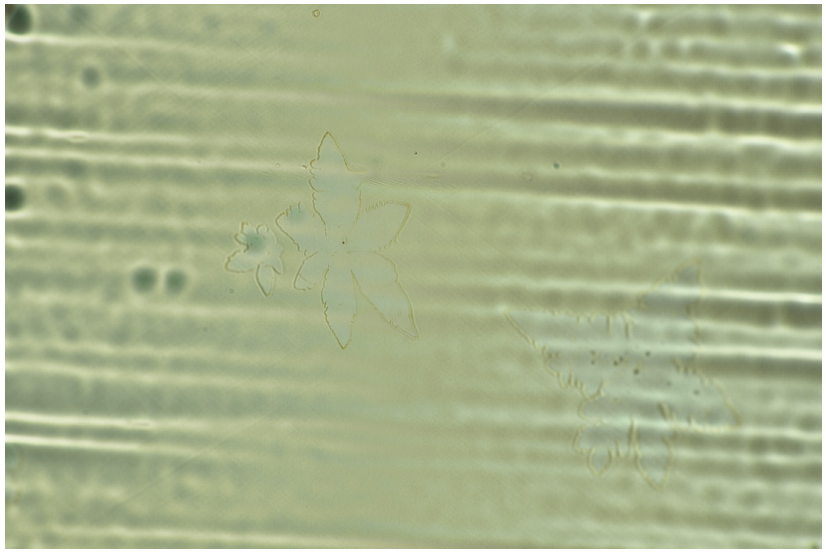


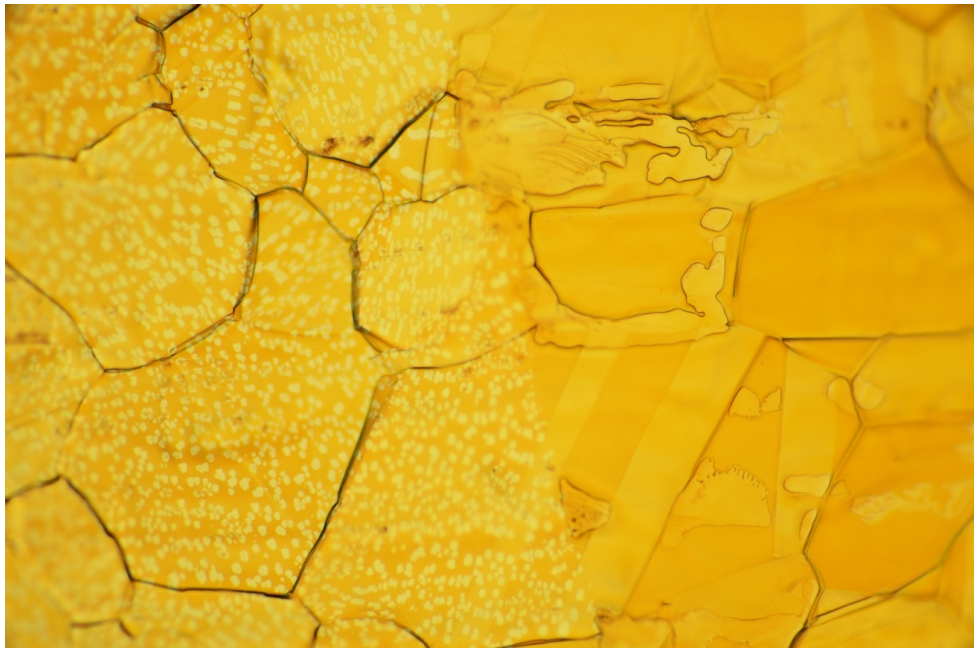
DOI: 10.5772/56435

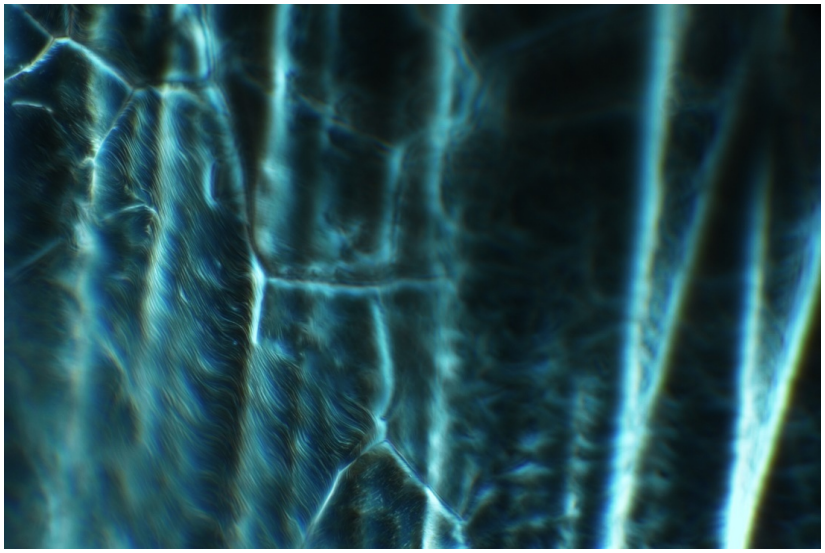

5LG
SLG
6LG
7LG
BLG
20um

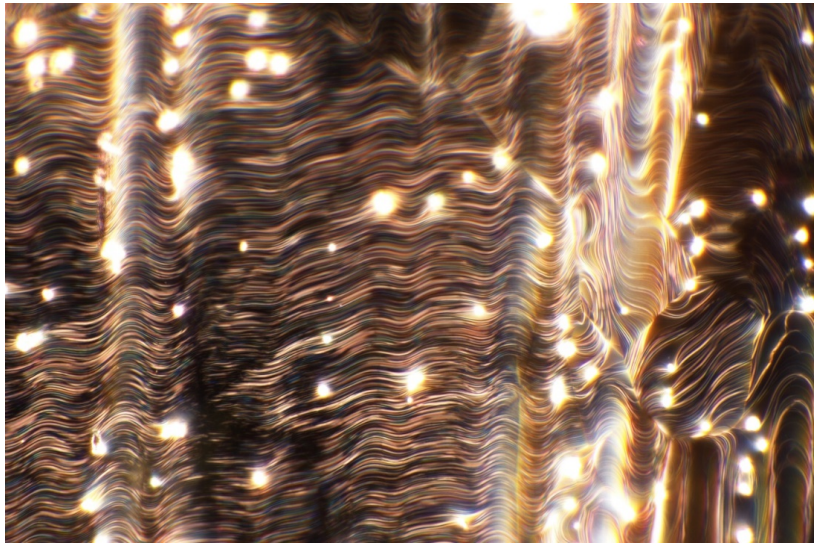

(b)
2D
G
2D'
SLG
BLG
5LG
6LG
7LG
Intensity (a.u.)
1500
2000
2500
3000
3500
Raman shift (cm-1)

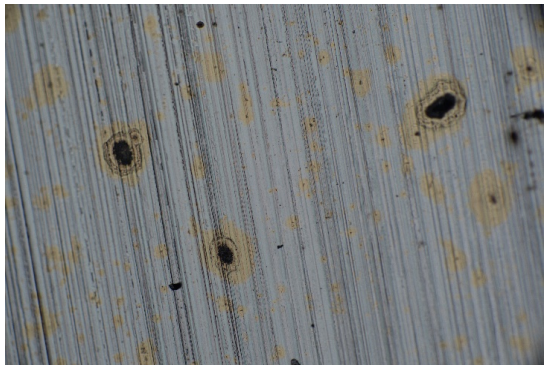

1040 °C
920 °C
820 °C
1000
1500
2000
2500
3000
Raman frequency, cm-1

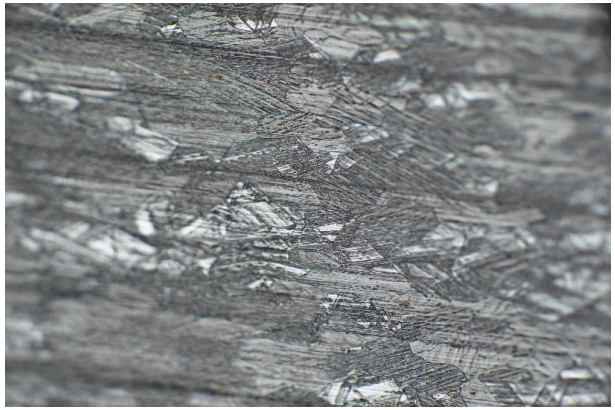


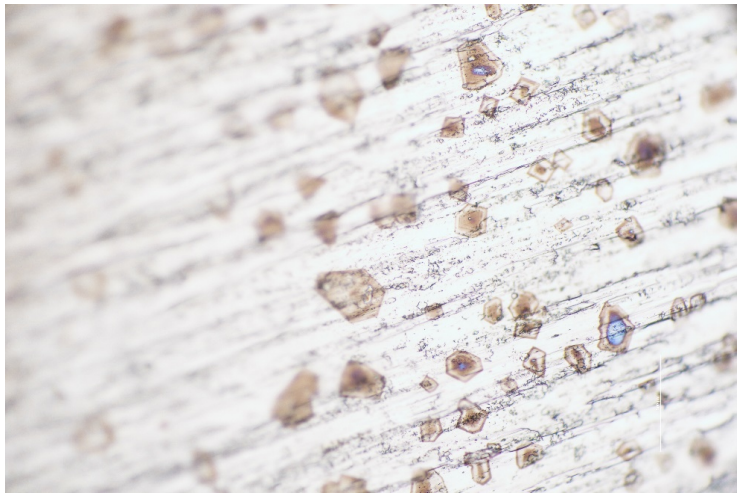


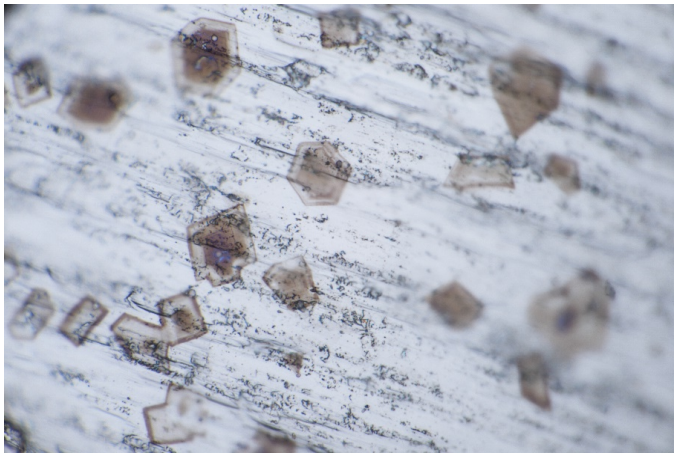


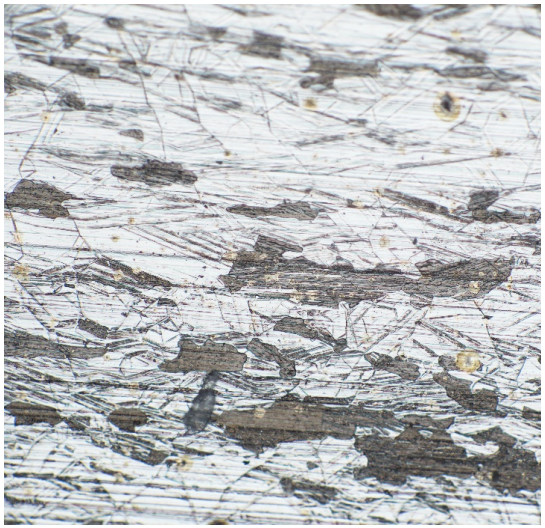




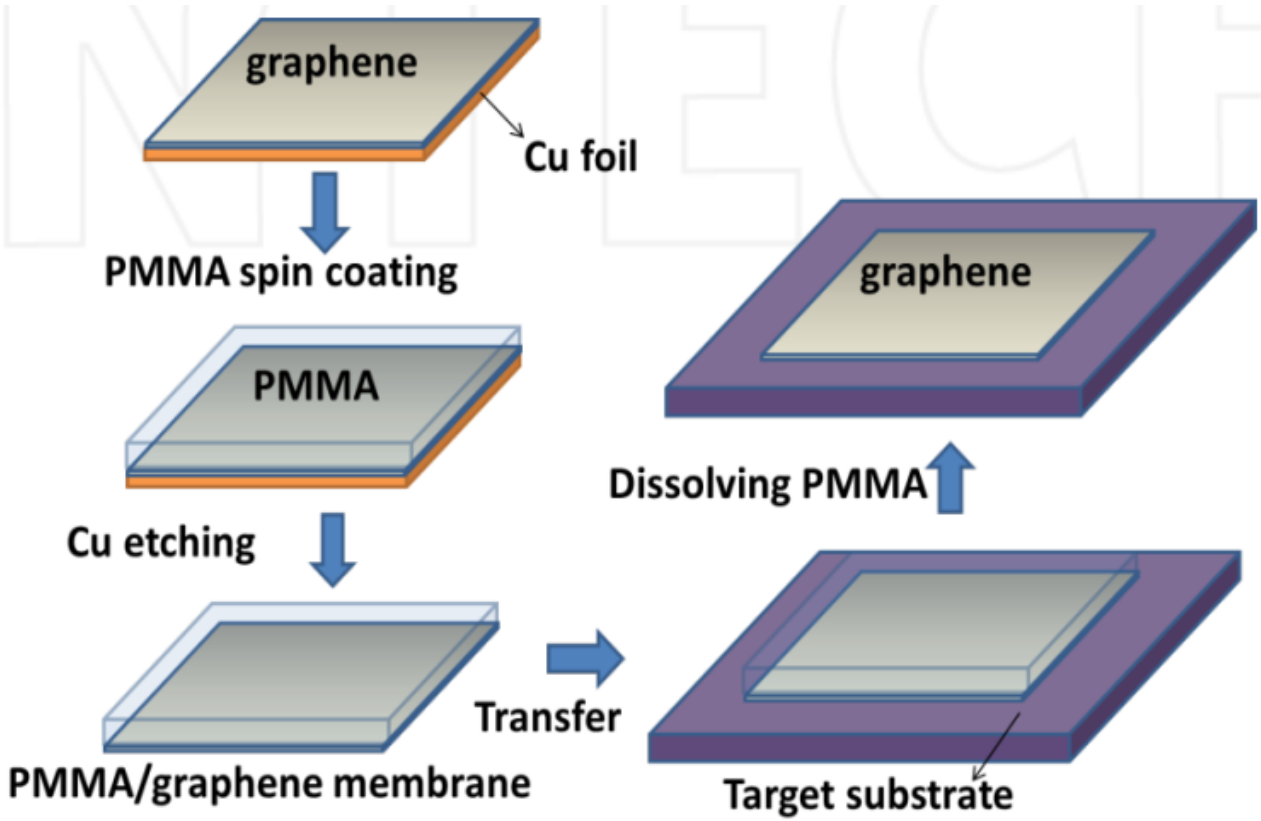


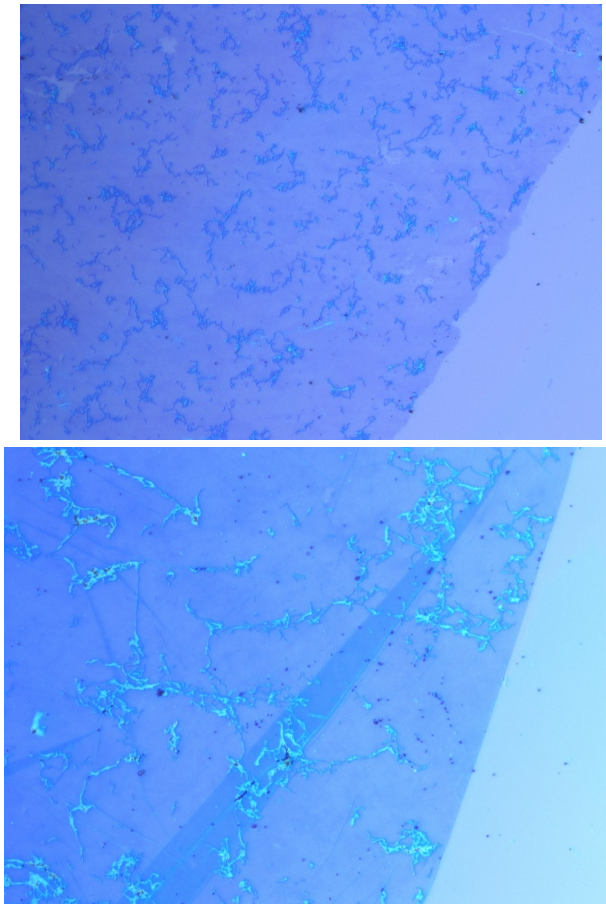






Transfer G





CVD scheme

Epitaxial grow of graphene on Ruthenium