

# Φ – 575 Διάλεξη 07

Φυσική διατάξεων δισδιάστατων ημιαγωγών

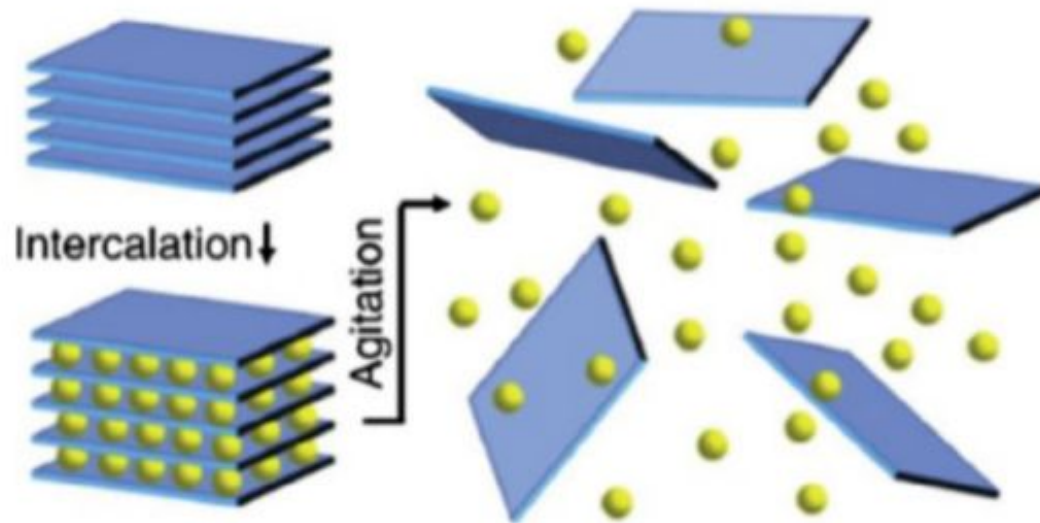
Γιώργος Δεληγεώργης ([deligeo@physics.uoc.gr](mailto:deligeo@physics.uoc.gr))

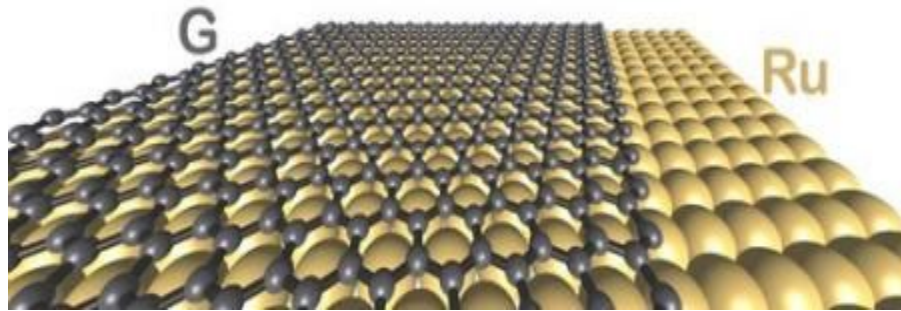


Χρησιμοποιώ αρχικό φυλλομορφο υλικό

Μια πηγή ενεργειας (sonicator)

Και καποιο χημικό που βοηθάει την αποφολίδωση (surfactant)





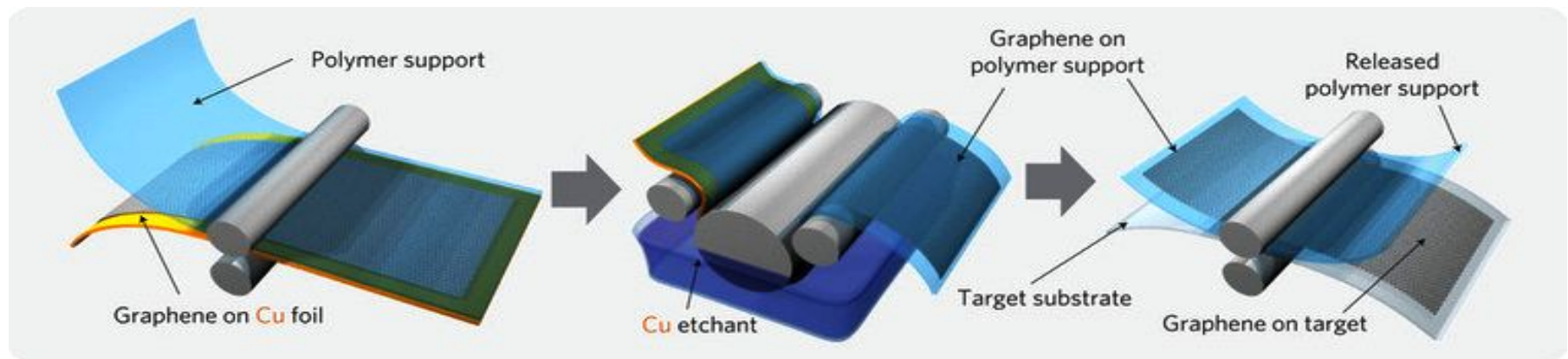
P.W. Sutter et. al., Nature Materials 7, 406 - 411 (2008)

Mobility as high as 20.000

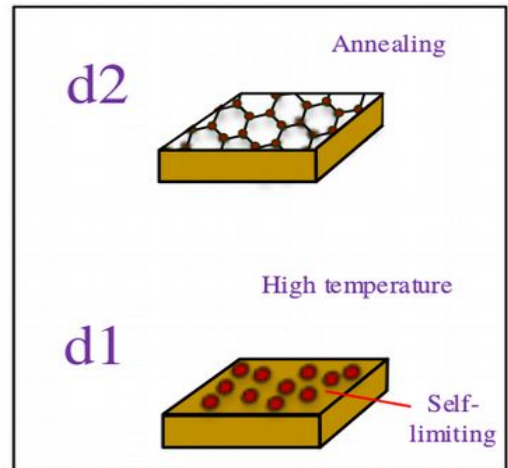
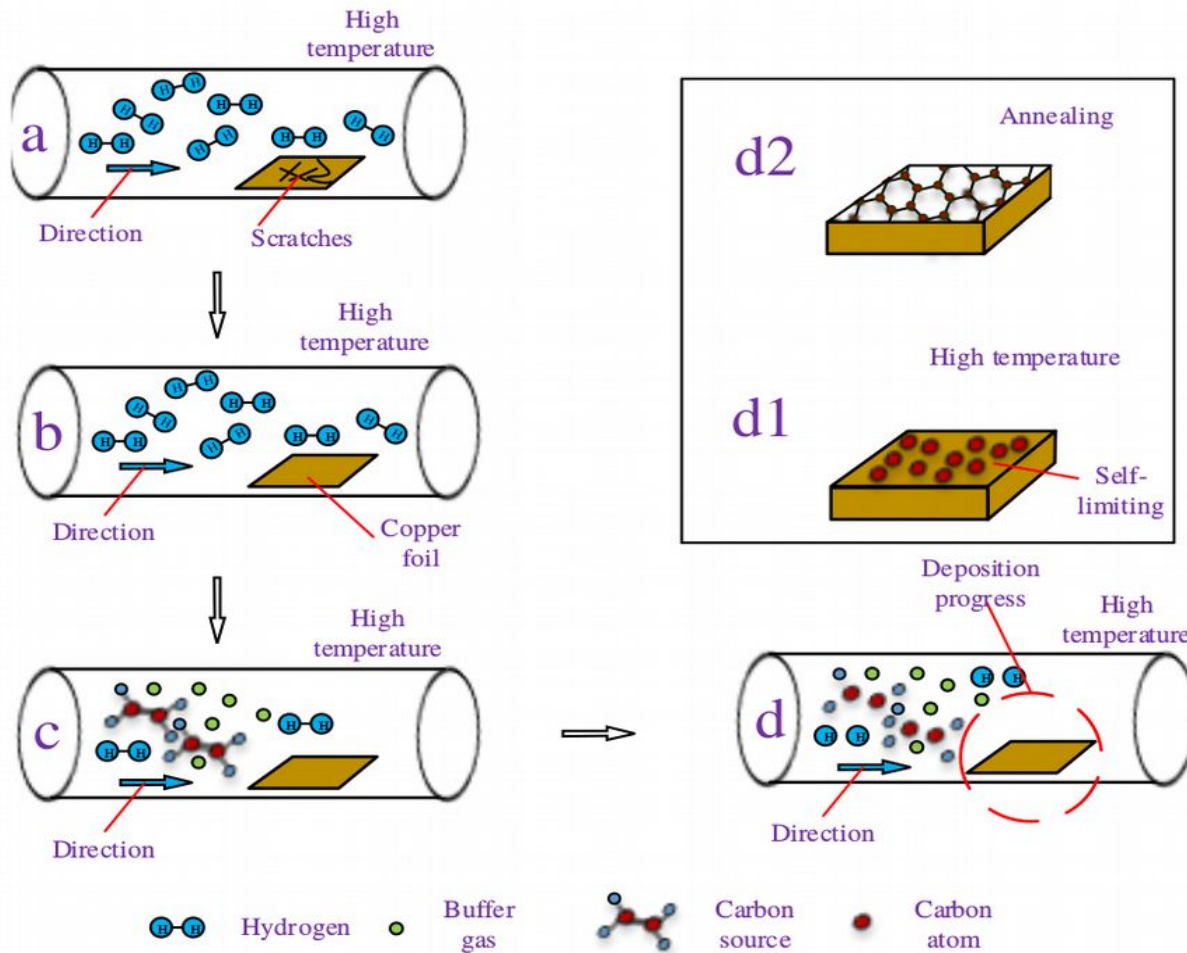
- **Graphene growth by CVD on metals**
- **Monolayer or few layer graphene**
- **Limited in size by substrate area**
- **Temperature ~700 C (CMOS compatible)**
- **Easy transfer to arbitrary substrates**

*Ir, Ni, Cu, Pt, Fe*

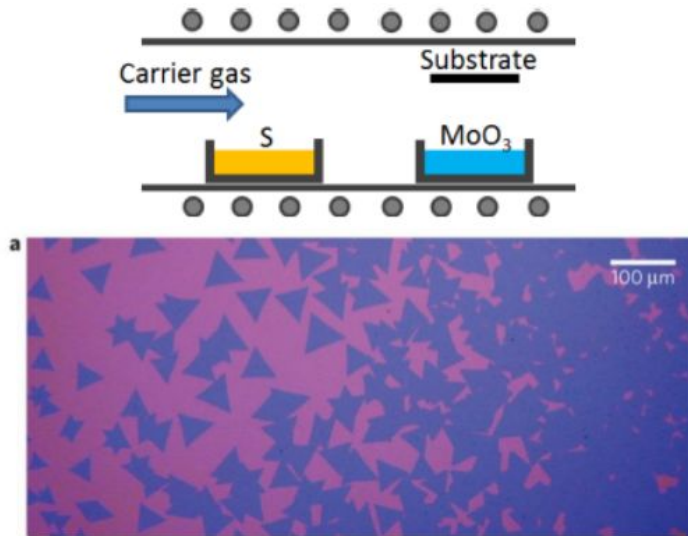
*Samsung 30 inch graphene for transparent electrodes*



Sukang Bae et al, Nature Nanotechnology Vol.5 ,pp 574–578 (2010)

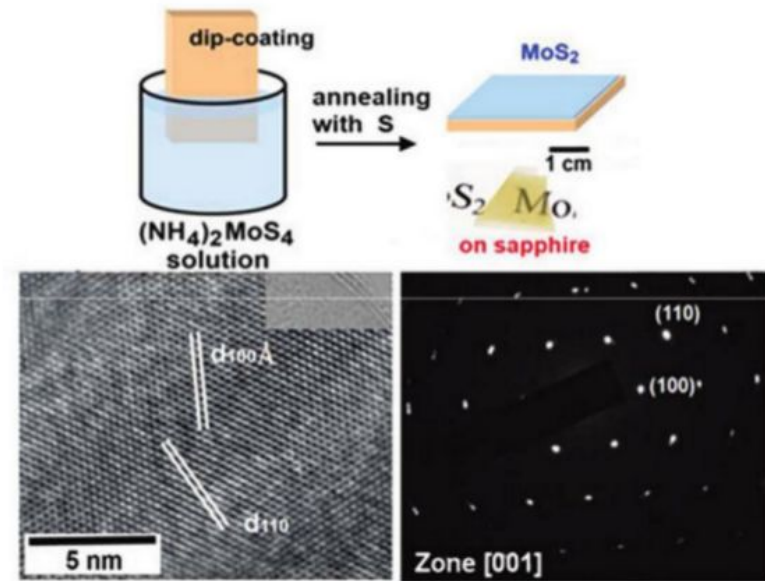


## MoS<sub>2</sub> by MoO<sub>3</sub>/S CVD at 700°C



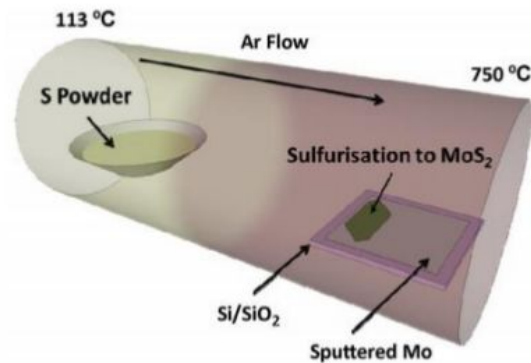
van der Zande et al., Nat. Mater. 12, 554 (2013)

## MoS<sub>2</sub> by thermolysis at 1000°C



K. K. Liu et al., Nano Lett. 12, 1538 (2012)

## Sulfurization of sputtered metal



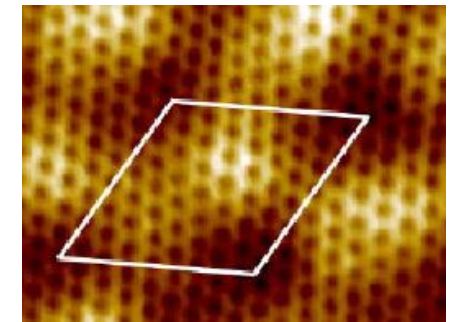
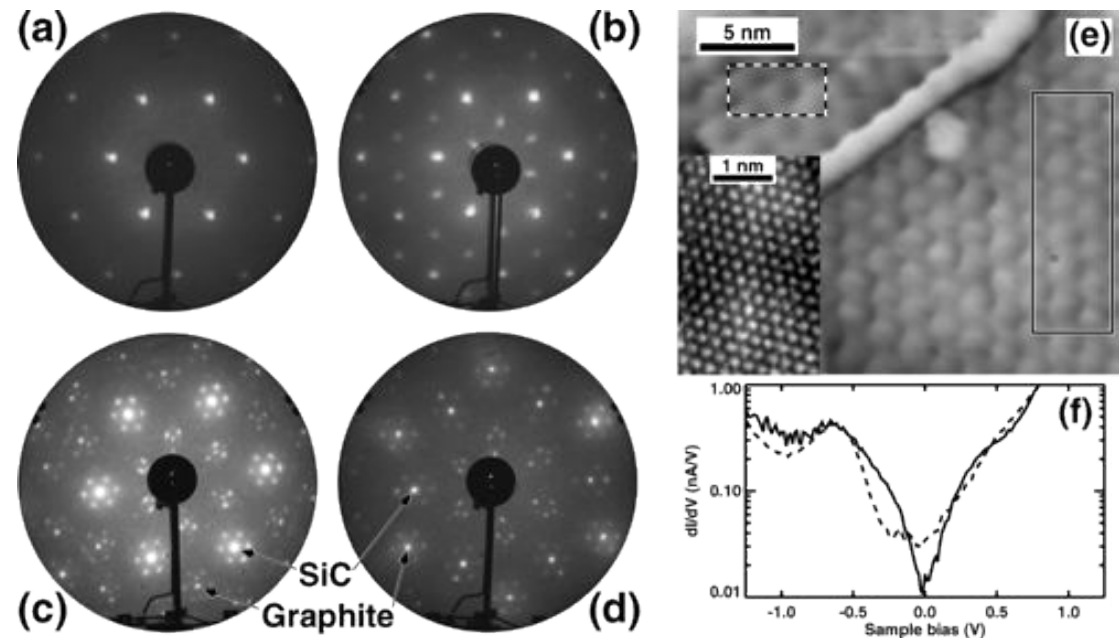
Gatensbv et al., Appl. Surf. Sci. 297, 139 (2014)

**Challenge – how to maintain Mo:S = 1:2?**

*SiC thermal decomposition  
Monolayer or few layer graphene  
limited in size by substrate area*

*GeorgiaTech (Walt de Heer) were  
working on graphene  
Well before 2004!!! But...*

*Removal from substrate difficult  
Mobilities lower than ~5.000  
Too high temperatures (>1100 C)*



*J. Phys. Chem. B, 2004, 108 (52), pp 19912–19916*