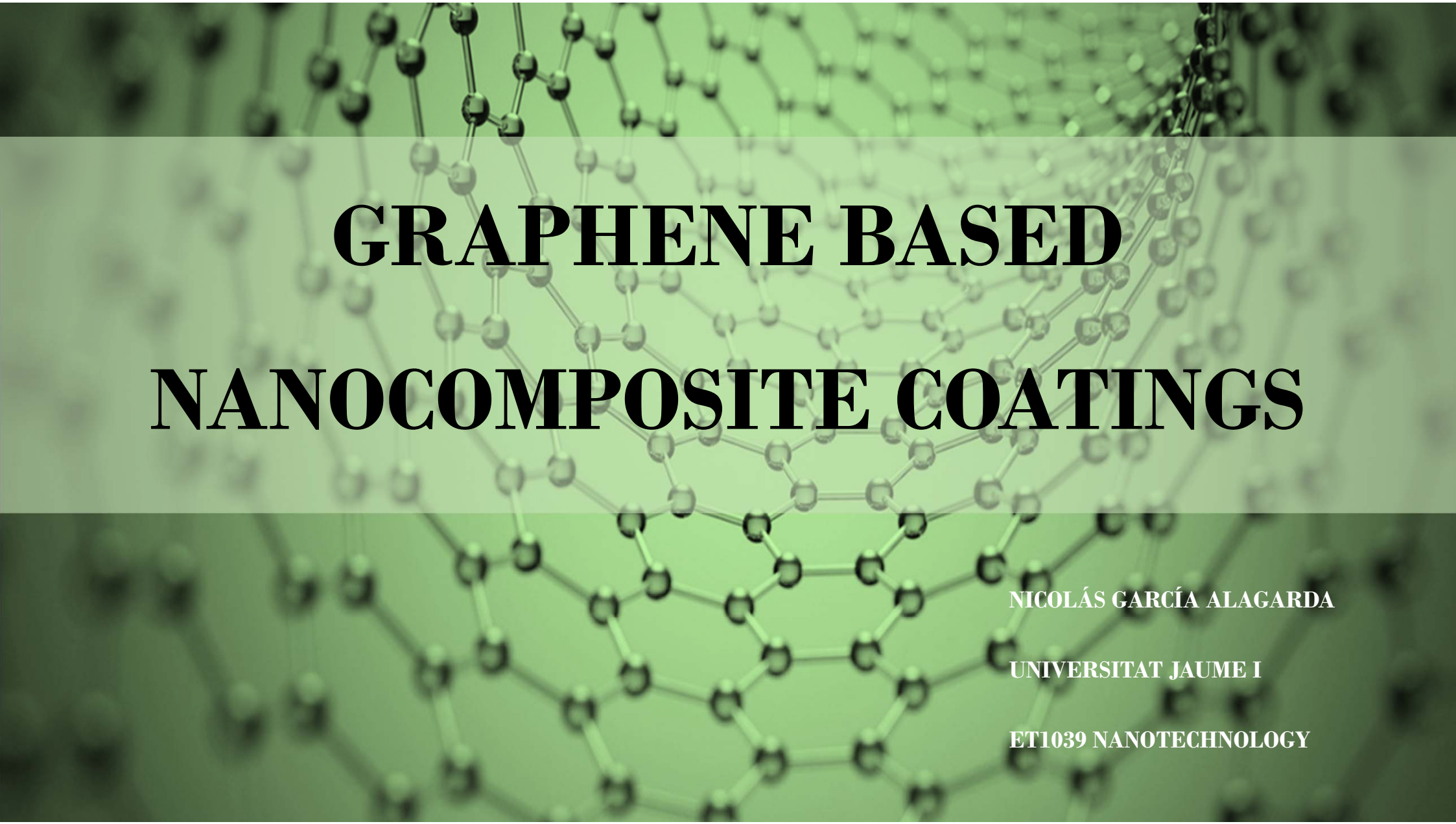


GRAPHENE BASED NANOCOMPOSITE COATINGS

NICOLÁS GARCÍA ALAGARDA

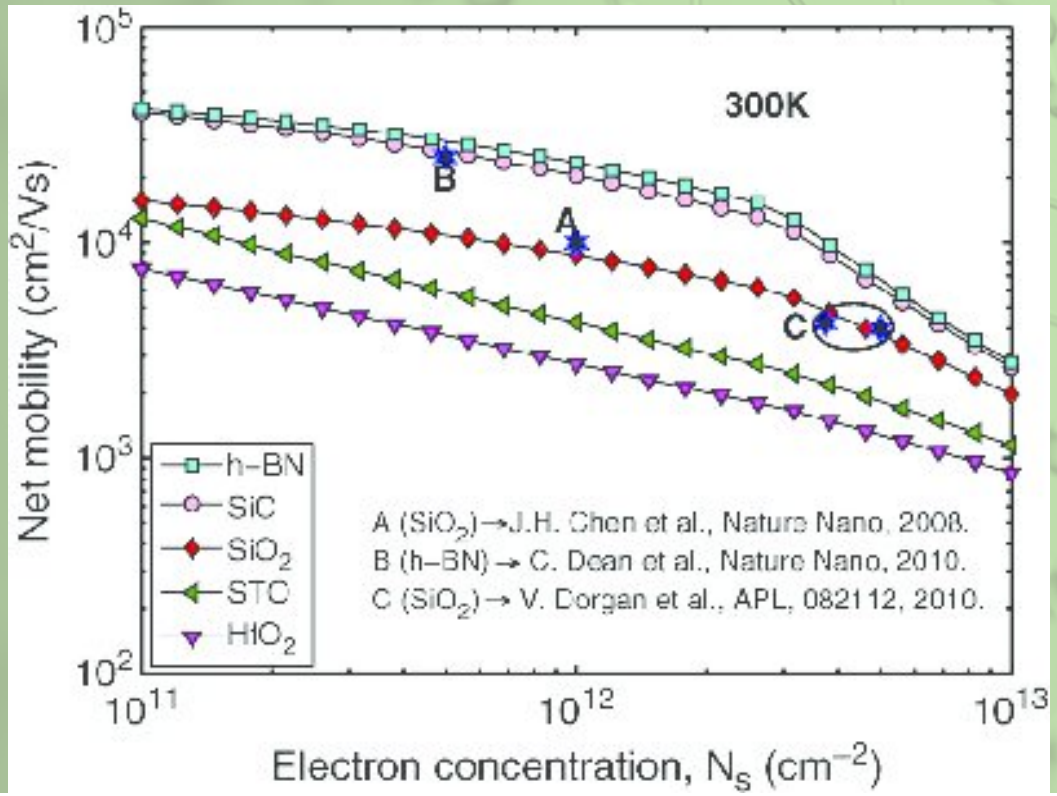
UNIVERSITAT JAUME I

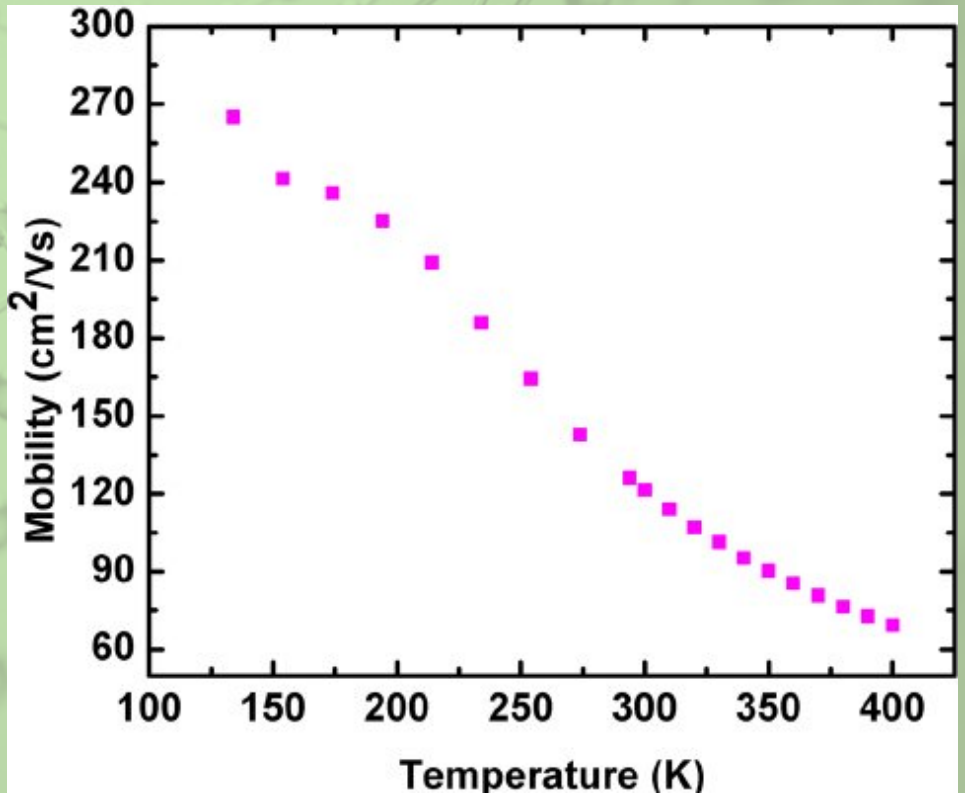
ET1039 NANOTECHNOLOGY

INDEX

GRAPHENE

- **ELECTRON MOBILITY: 250.000 cm^2/V**





GRAPHENE

- MONOLAYER TRANSMITTANCE: 97,7%

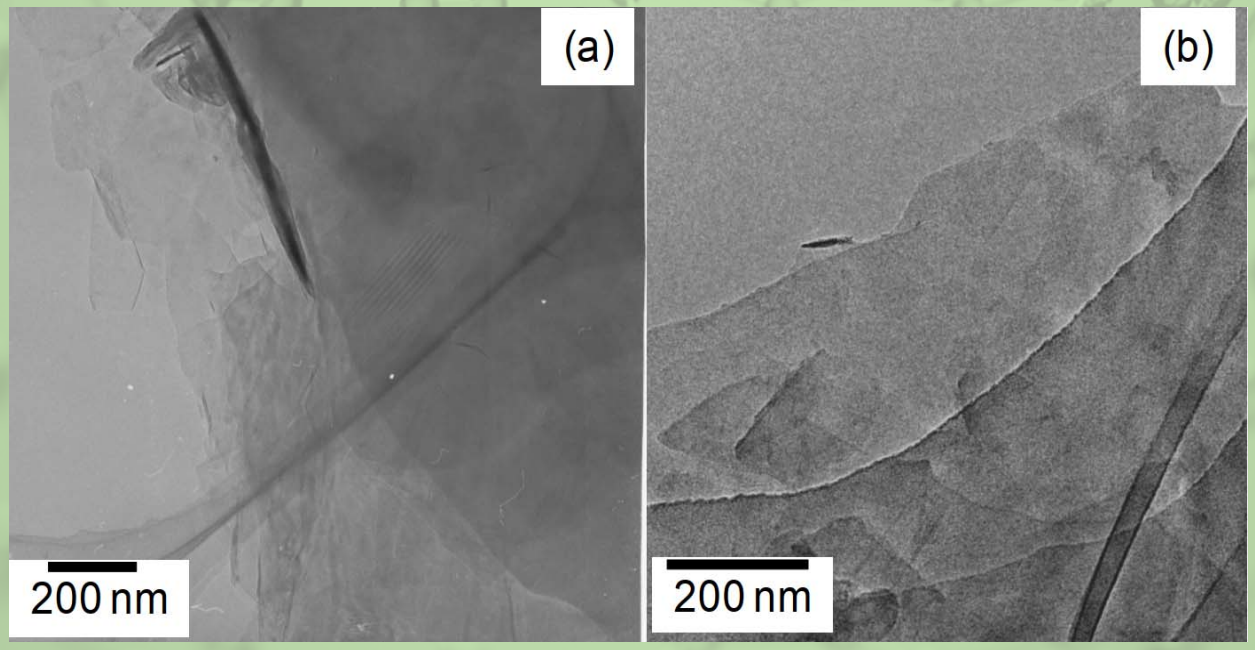
- YOUNG'S MODULUS: 1 TPa

- TENSILE STRENGTH: 130 GPa

- THERMAL CONDUCTIVITY: 5.000 W/m/K

GRAPHENE: SYNTHESIS

1) MECHANICAL EXFOLIATION



GRAPHENE: SYNTHESIS

2) CHEMICAL VAPOUR DEPOSITION

- Large scale production+ control of the number of layers

3) REDUCTION AND SYNTHESIS OF GO

- Simpler procedure → Hummers

GRAPHENE: FUNCIONALIZATION

- STABILIZE SUSPENSION- AVOID AGGLOMERATION

- INTERFACIAL UNION MATRICES-LAYERS

  - ORGANIC SPECIES

  - MACROMOLECULES

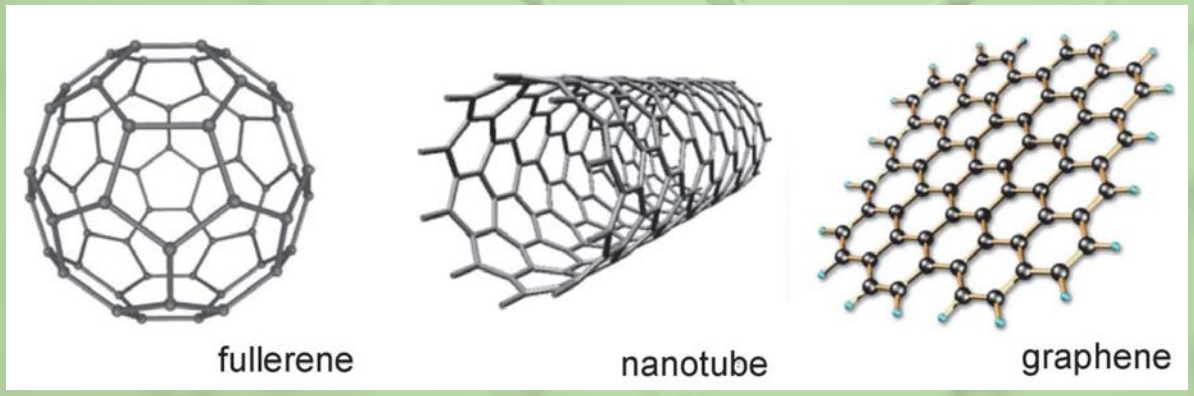
  - NANOPARTICLES

GRAPHENE BASED COATINGS

- GNPs (MLG), CNT, GO…

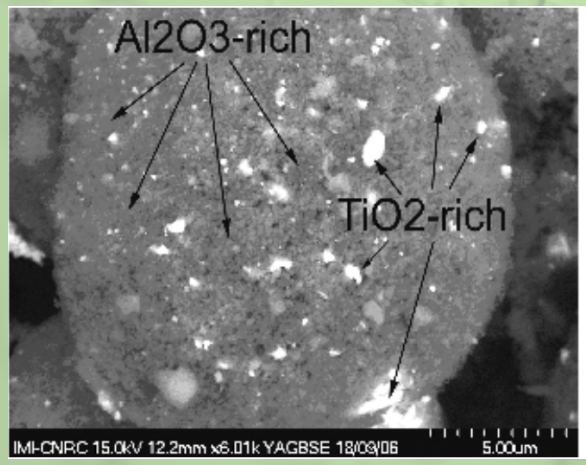
- Si_3N_4/G: + 2% weight → + 235% fracture thoughness

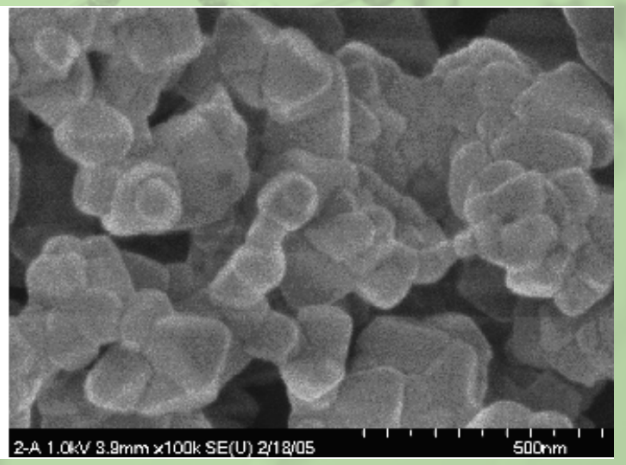
- Alumina/CNT: + 0,07% weight →- 50% wear



COATING METHODS

- DIP
- EPD
- IN SITU POLEMERIZATION
- ROTATION
- CVD
- THERMAL SPRAYING
- SOL-GEL
- LBL
- DIRECT AND CURED





APPLICATIONS: ELECTRICAL

- **TOUCH PANELS**
  - **GO-hydrazine: 2200 Ωsq-1; 84%**
  - **Graphene+EPD → glass: 4600 Ωsq-1; 83,8%**
  - **GO → PET → 1800 Ωsq-1; transparency + flexibility**

APPLICATIONS: ELECTRICAL

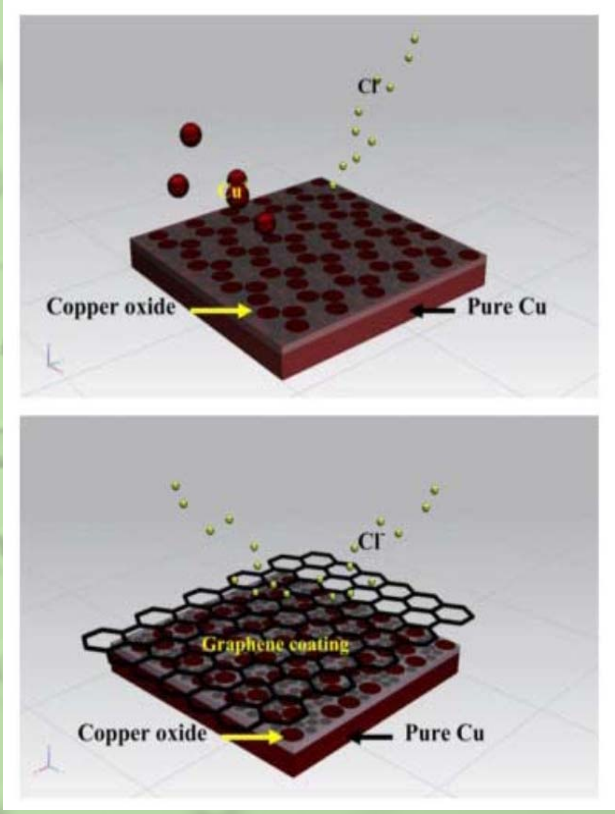
- **SPONGE+GO/MnO2 → SUPERCAPACITOR**
  - **10.000 cycles: degradation 10%, 90% capacitancy**
  - **Specific current: 10 A/g**
  - **Specific energy: 2,08 Wh/kg**
  - **Specific power: 94 kW/kg (0,8 V)**

APPLICATIONS: ELECTRICAL

- **HIGH PERFORMANCE STORAGE LITHIUM IONS**
  - **Reversible capacity: 810 mAh/g**
  - **150 cycles (1,5:0,01 V, 0,1 A/g)**
- **PHOTOCATALITYC ACTIVITY**
  - **G/TIO2 (dip coating)→ FTO**

APPLICATIONS: PROTECTION

- **ANTICORROSION MECHANISM**
  - **Graphene – CVD → Copper**
  - **φ = 0,18**

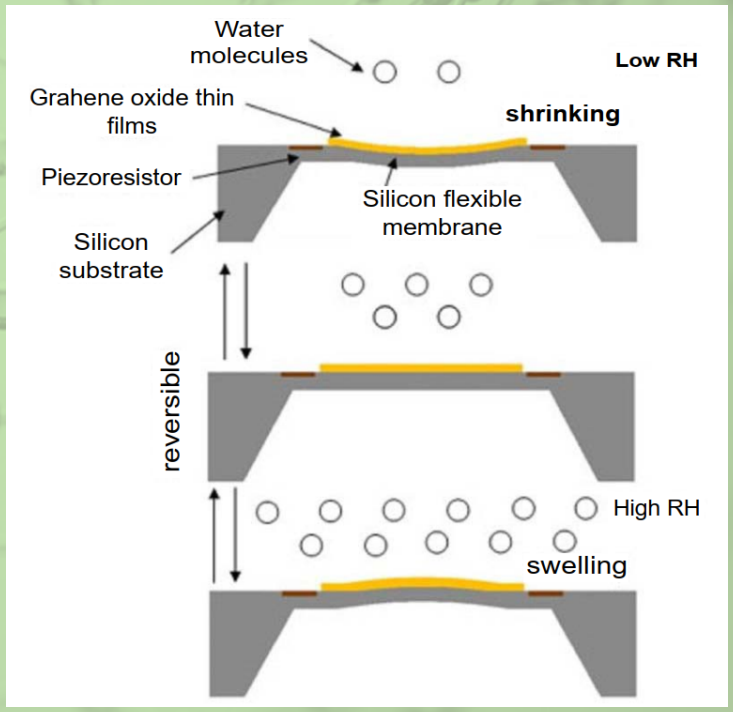


APPLICATIONS: PROTECTION

- **OXYGEN BARRIER**
  - **GO (Hummers)/PEI – LBL → PET**
- **SUPER-HYDROPHOBYC**
  - **GOSiO_2**
  - **High conductivity: 104 Sm^{-1}**

APPLICATIONS: DETECTION

- **QUARTZ CRYSTAL MICROBALANCE**
  - **GO (Hummers) – rotation**
  - **Range: 6,4 – 93,5 %**



APPLICATIONS: ABSORTION

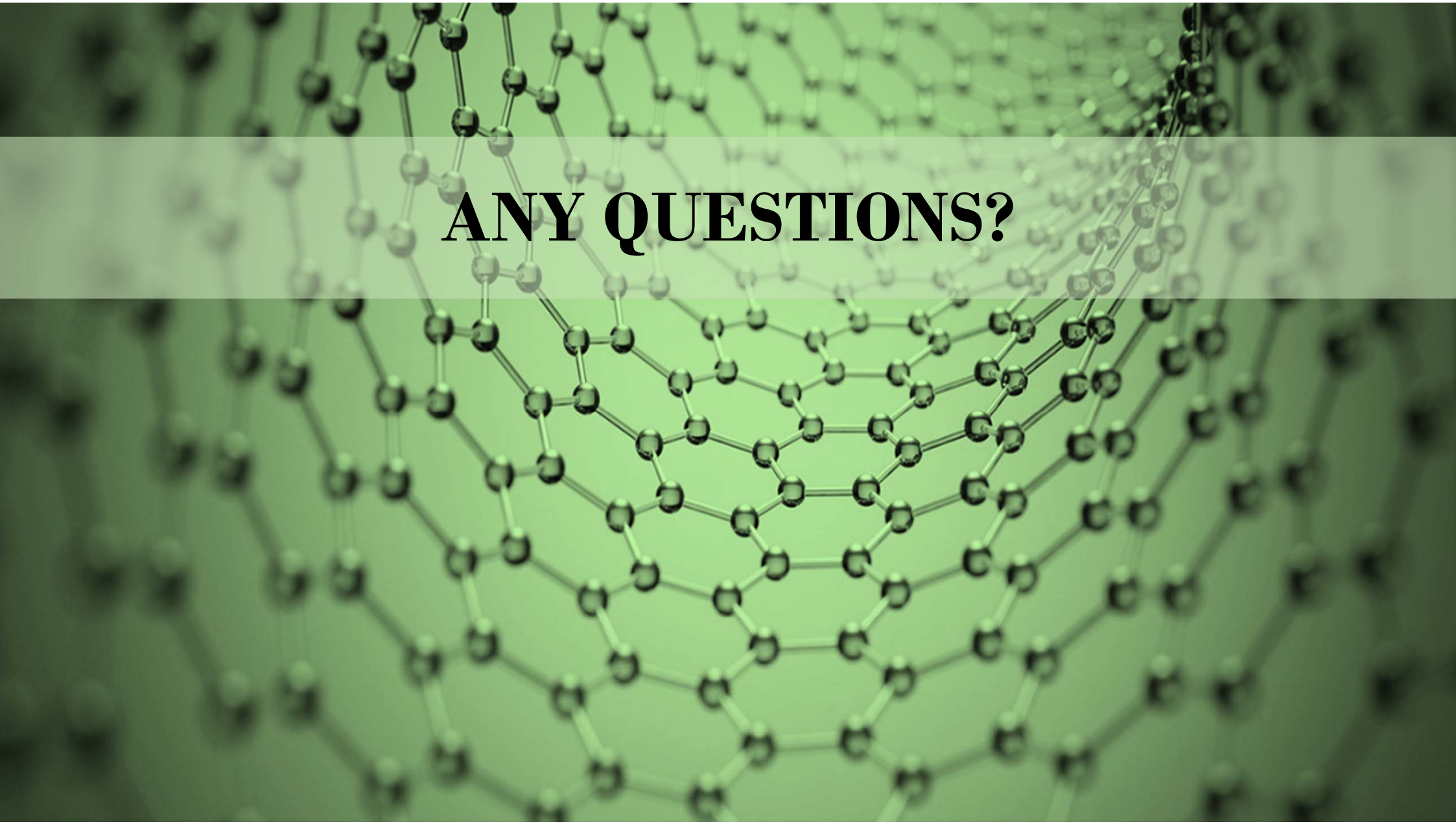
- **SPONGE**
  - **Graphene – inmersión → Melamine**
  - **Absortion = 165 weight**
  - **Descomposition temperature: x64**

APPLICATIONS: POLYMERIC

- **DSSC**
  - **G/PBT**
  - **Percolation = 0,25 – 0,75%**
  - **n = 8,19% (solar → electricity)**

APPLICATIONS: MECHANICAL

- **PROPERTIES IMPROVEMENT**
  - **Graphene – SOL-GEL → PBT**
  - **Young's modulus: 69,8 → 118 Mpa**
  - **Tensile strength: 11,8 → 20,8 MPa**
  - **Elongation to the break: 324 → 138%**


ANY QUESTIONS?