NU-TEGRAM

FLAG-ERA

Marika Schleberger ■ Budapest, 13./14.4.2016

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Nanofluidics and Ultrafiltration with Track Etched Graphene-Polymer Composite Membranes

Potential Impact of Perforated 2D Materials

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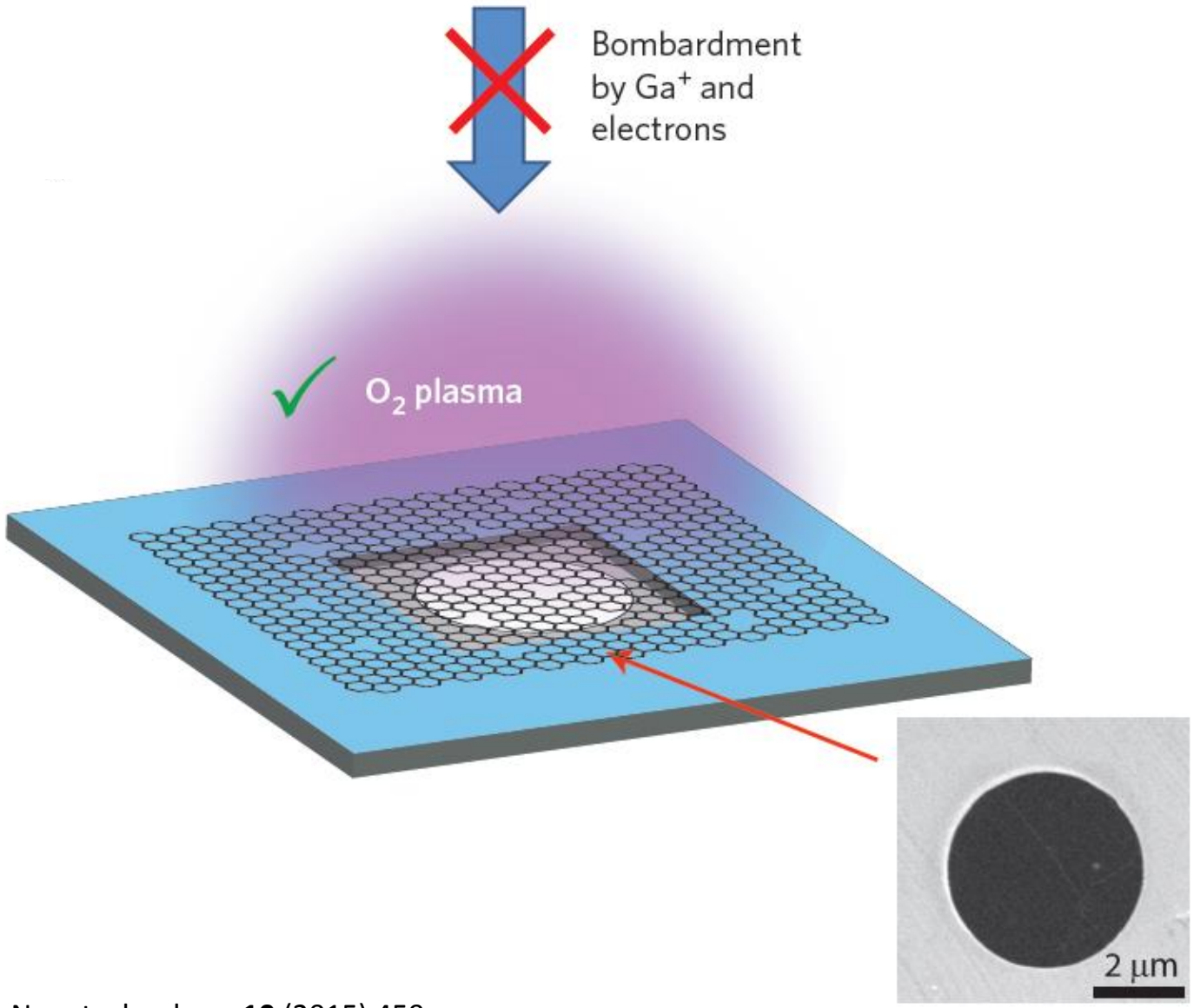
- Mechanical Strength
- Highly flexible
- High Selectivity
- High Permeability

- Stability & Handling
- Pores
  - Creation
  - Size
  - Distribution
- Scalability & Costs
- Retain specific advantages

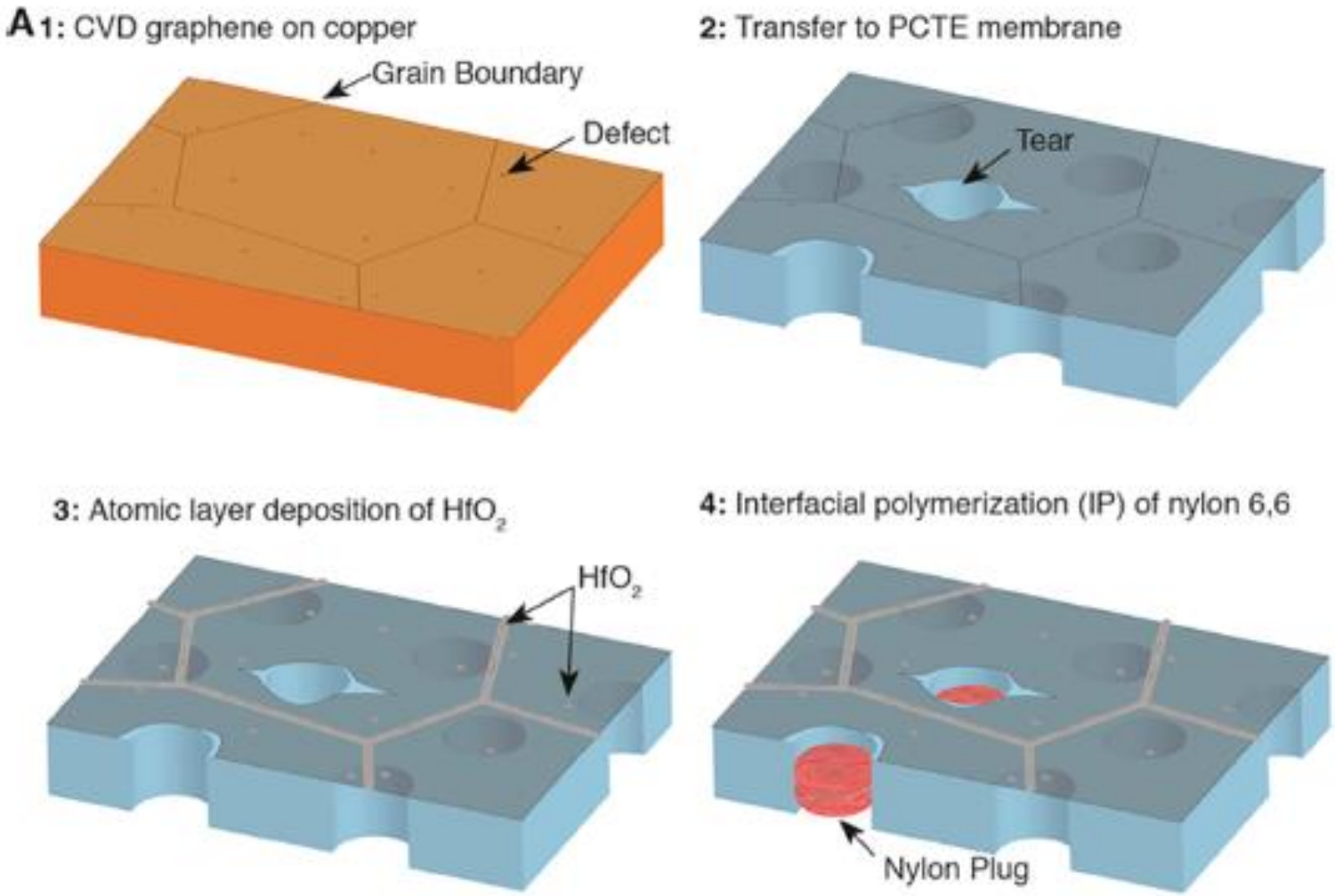
☞ **Highly selective filtering membrane (desalination, nano- and bio-filtration, …)**

Key Challenges: Stability and Pore Creation



Surwade et al., Nature Nanotechnology **10** (2015) 459

Key Challenges: Stability and Pore Creation



O´Hern et al., Nano Lett. **15** (2015) 3254

Scientific Background: Swift Heavy Ions Interacting with …

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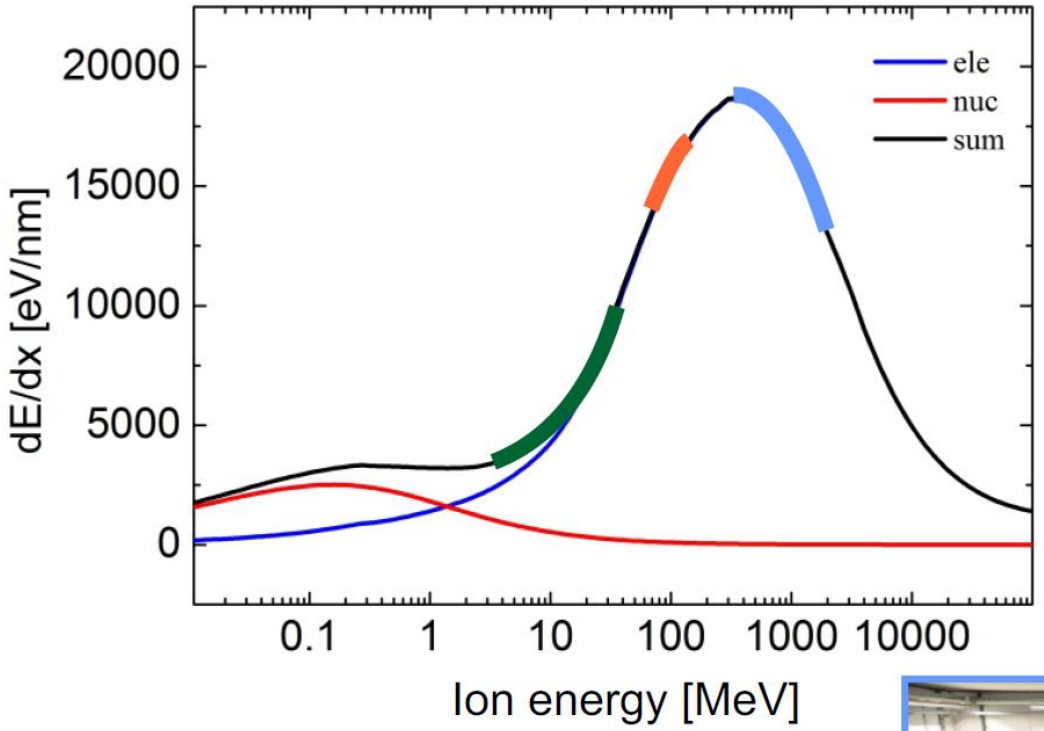
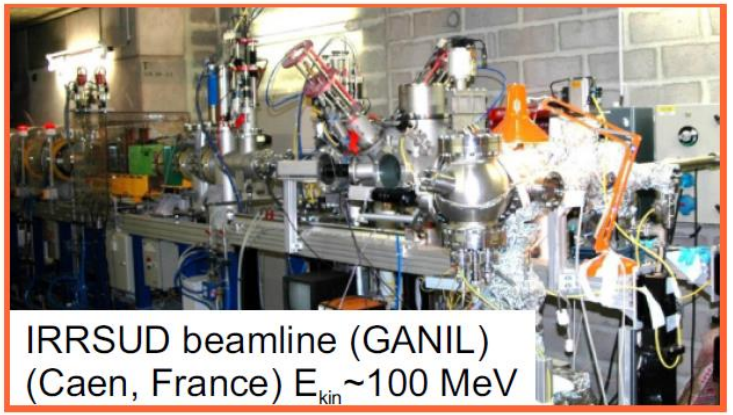


6 MV EN Tandem VdG (RBI)
(Zagreb, Croatia) E_{kin}<23 MeV



IRRSUD beamline (GANIL)
(Caen, France) E_{kin}~100 MeV

M branch, UNILAC (GSI)
(Darmstadt, Ger) E_{kin}~1000 MeV

… Graphene

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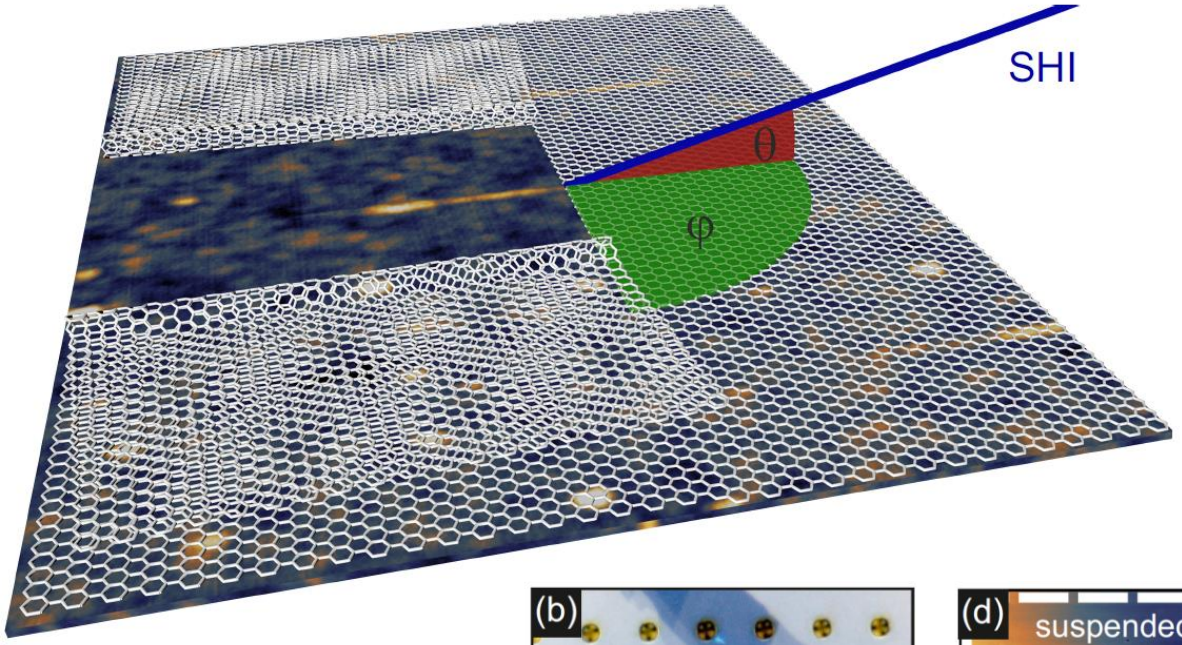

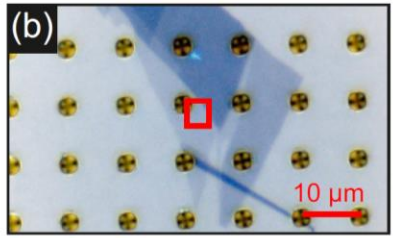

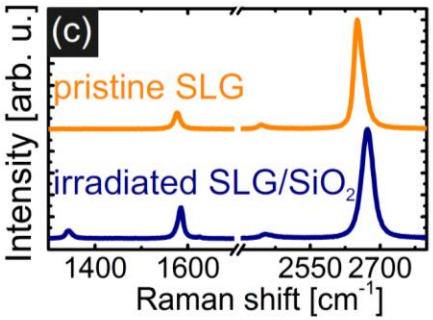

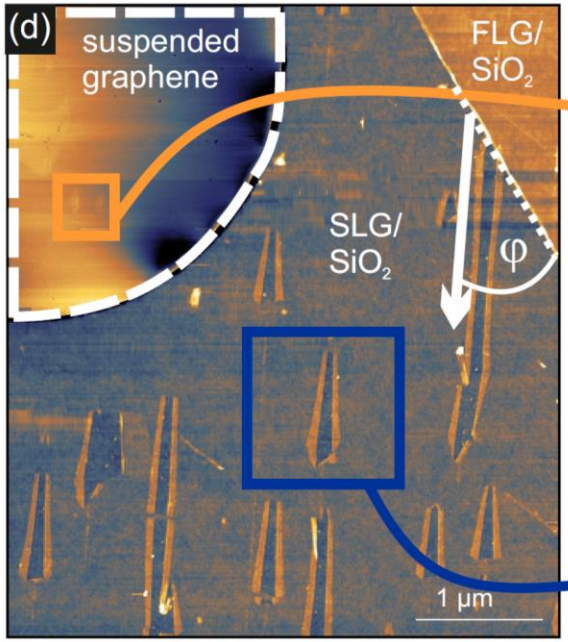

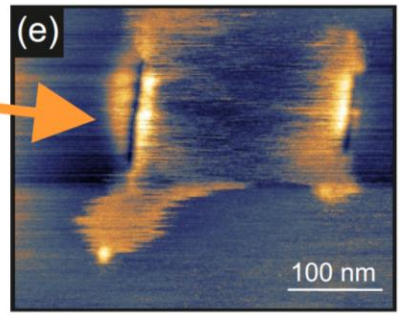

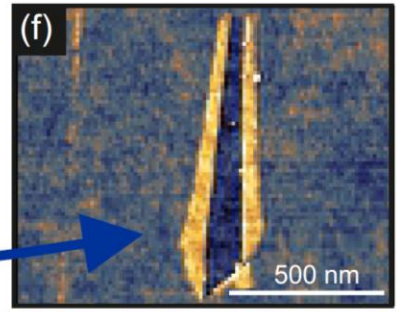

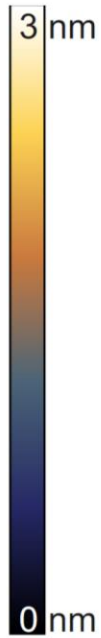

O. Ochedowski, M.K., H.L., M.S. et al.; Nanotechnology **26** (2015) 465302

Fabricating Synthetic Pores in Graphene with SHI

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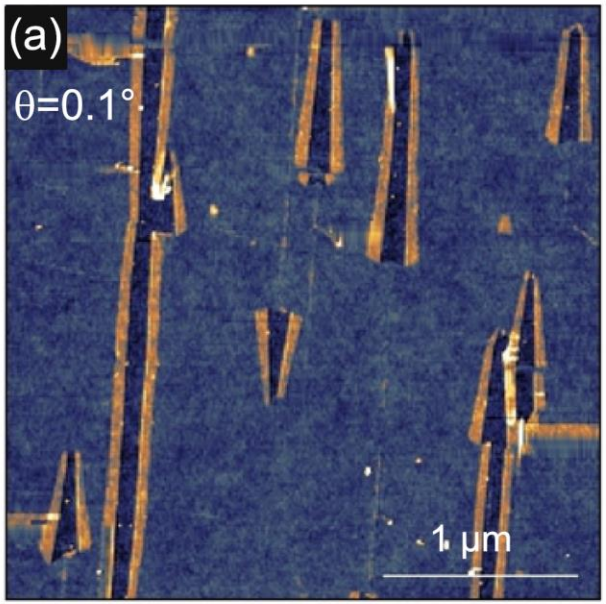

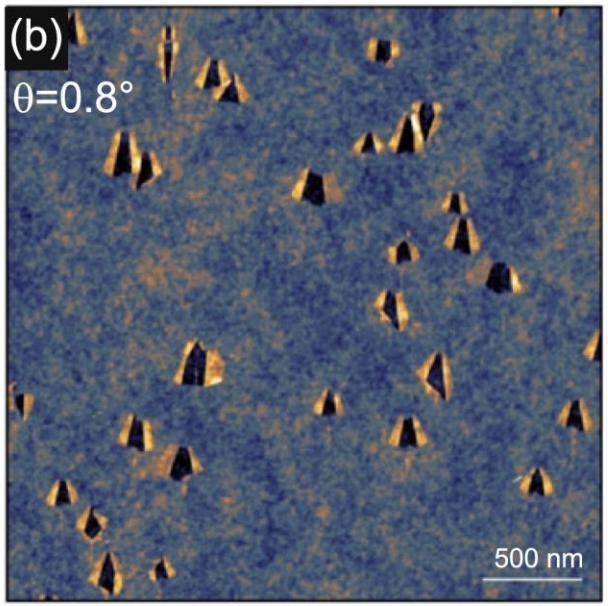

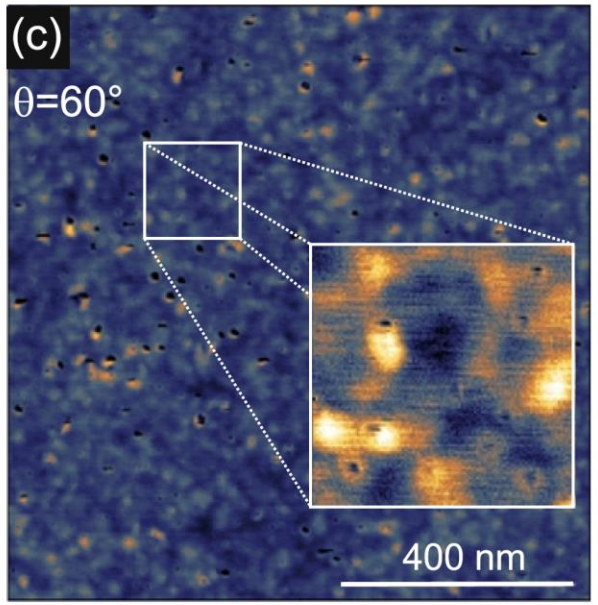

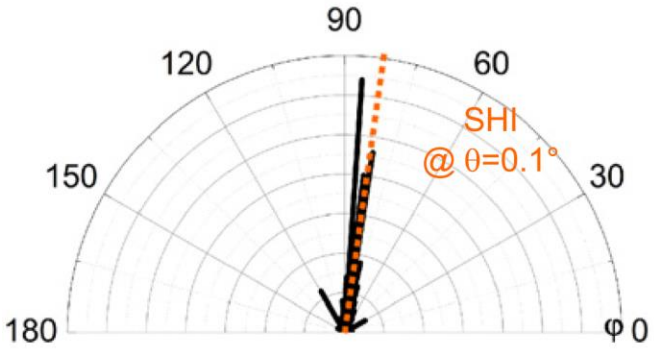

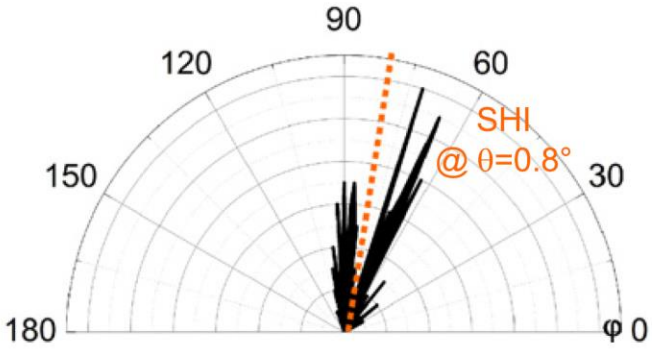

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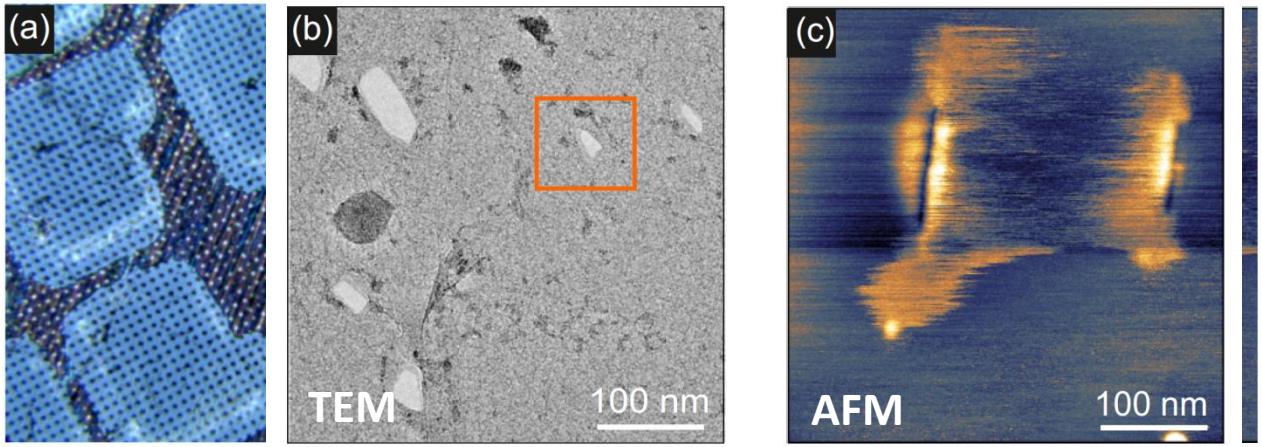
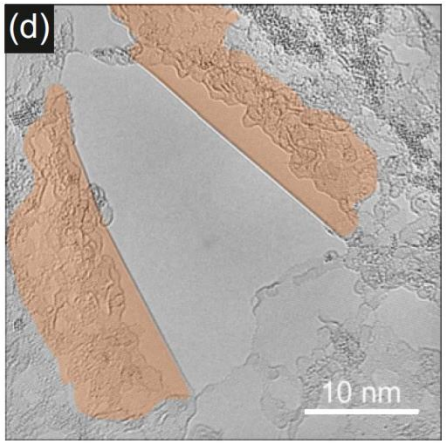
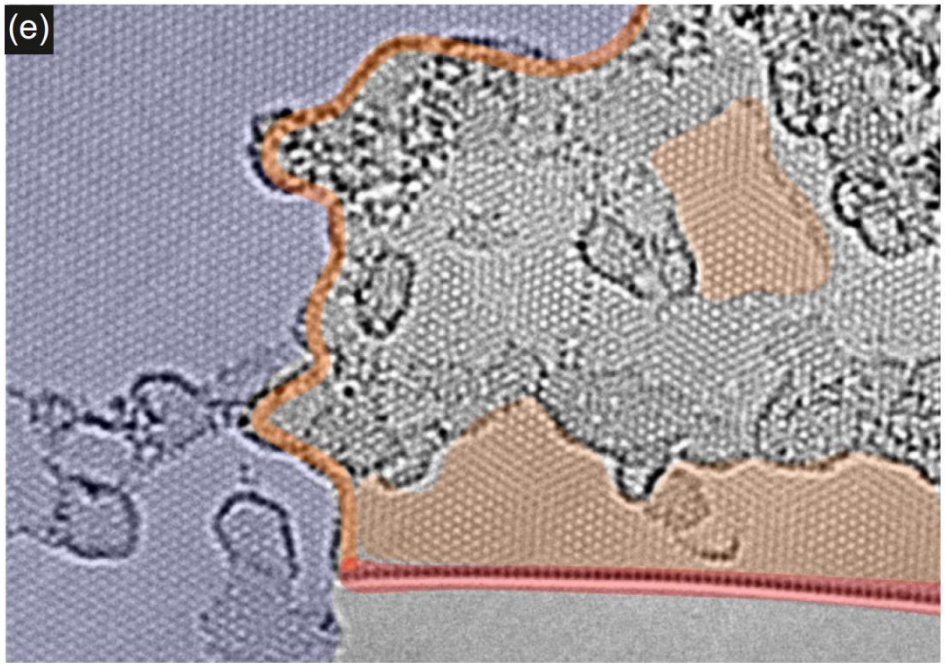
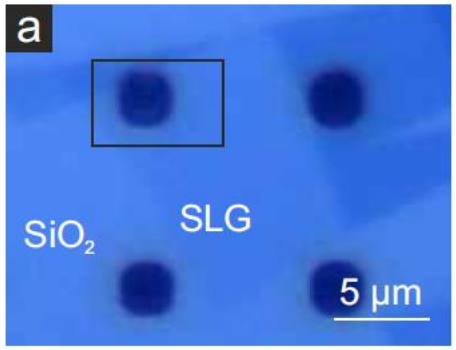
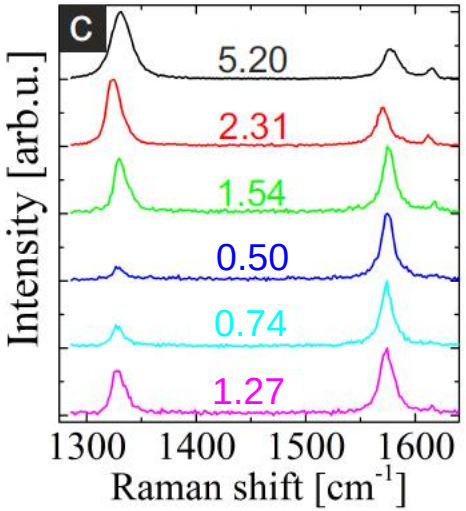


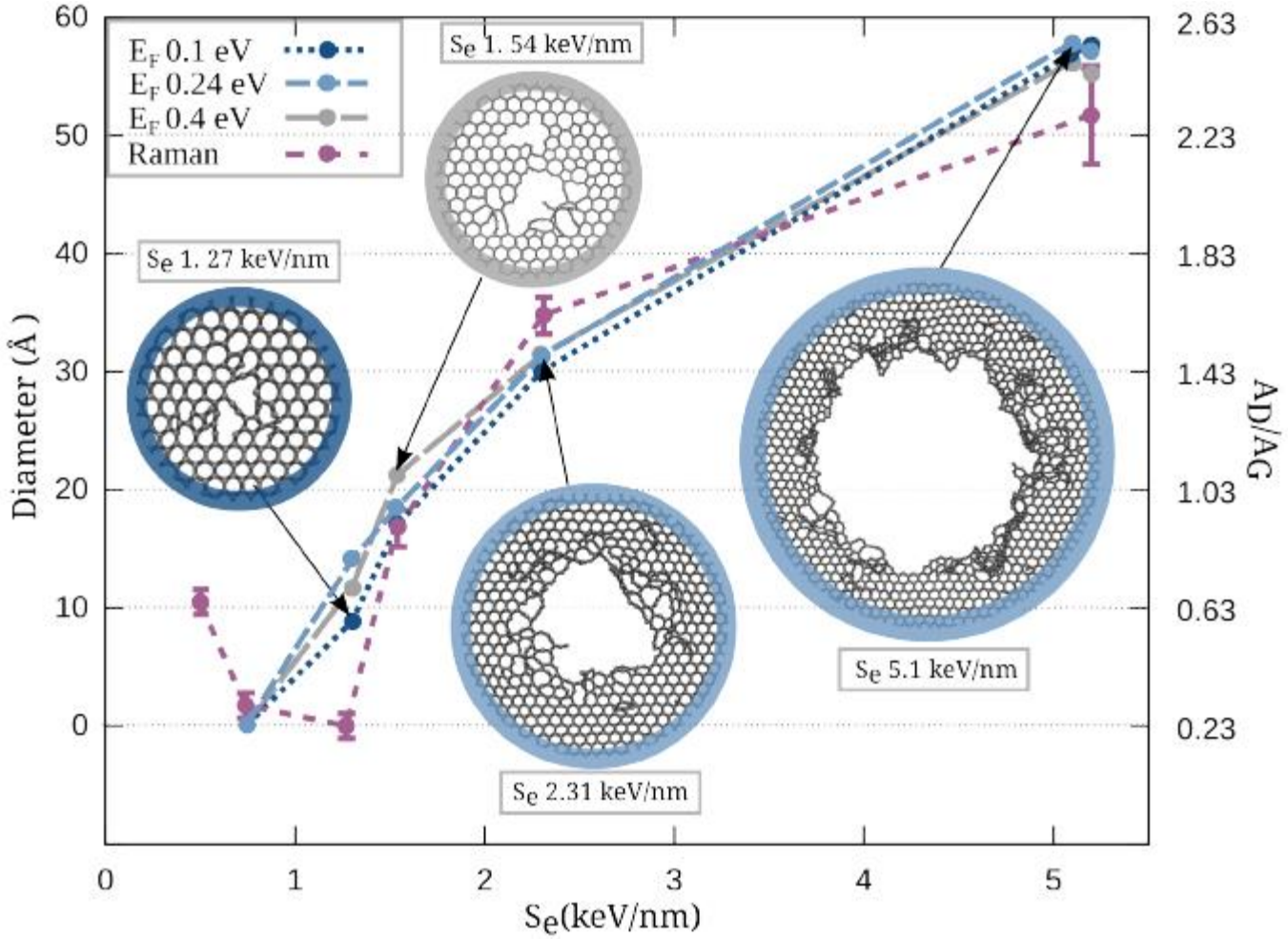




Fabricating Synthetic Pores in Graphene with SHI







H. Åhlgren, O. Ochedowski, F. Djurabekova, K. Nordlund, M.K., H.L., M. S. et al., in preparation

Towards Ultrafiltration-Membranes

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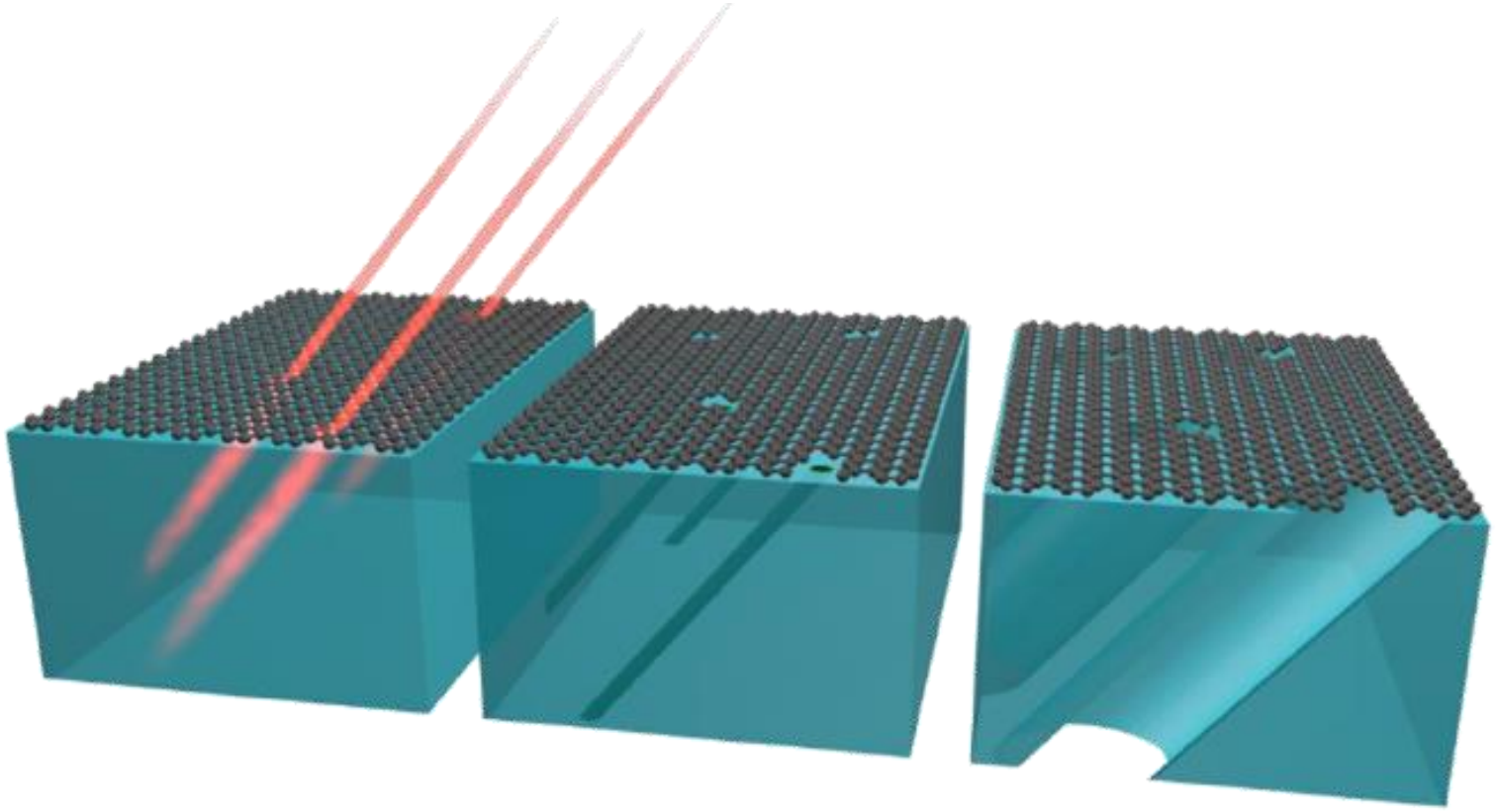
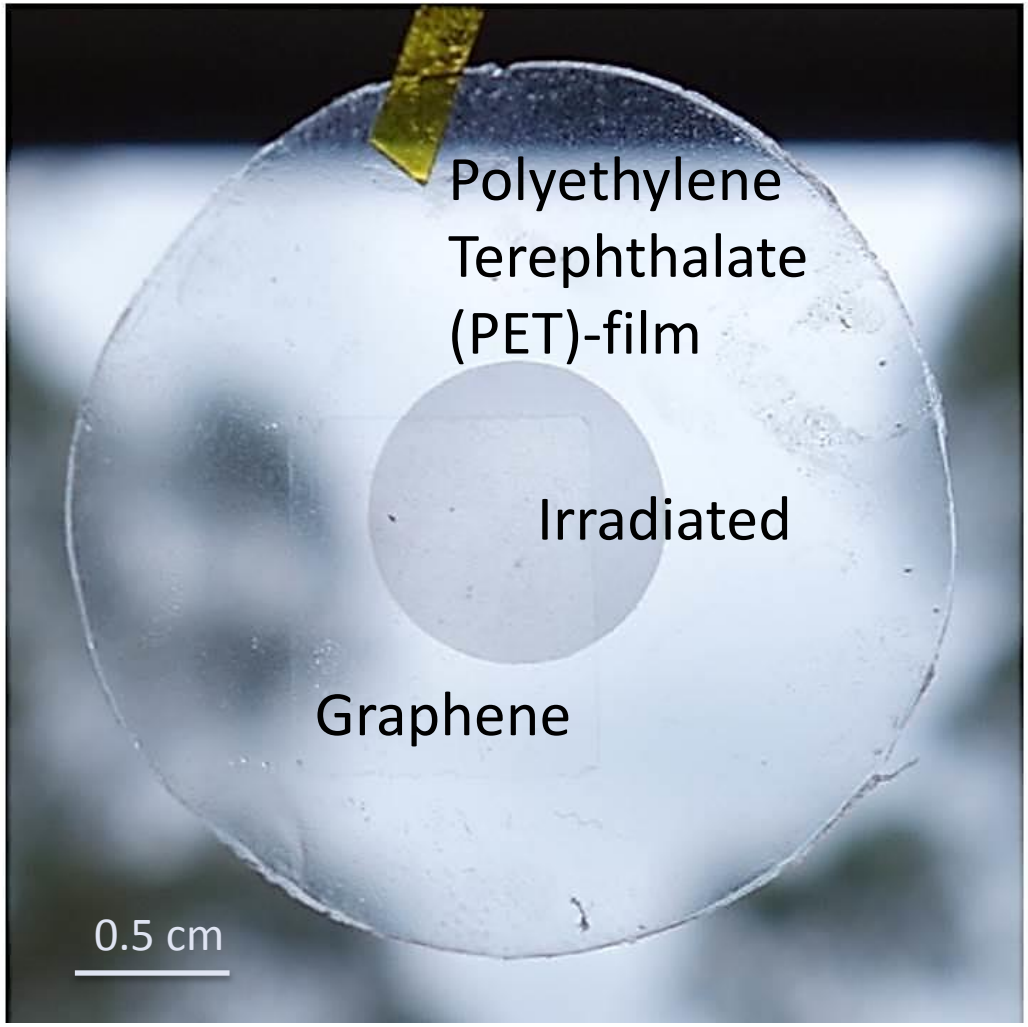
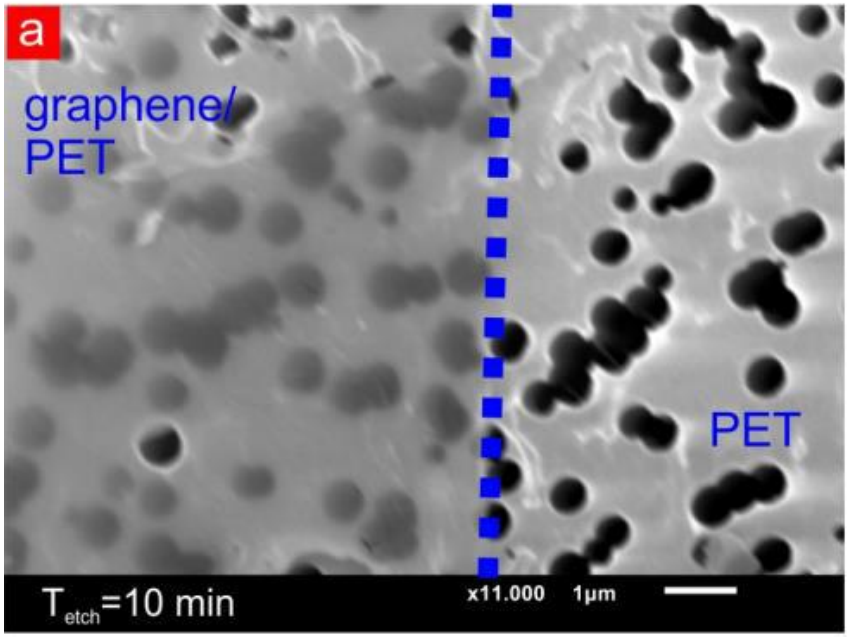


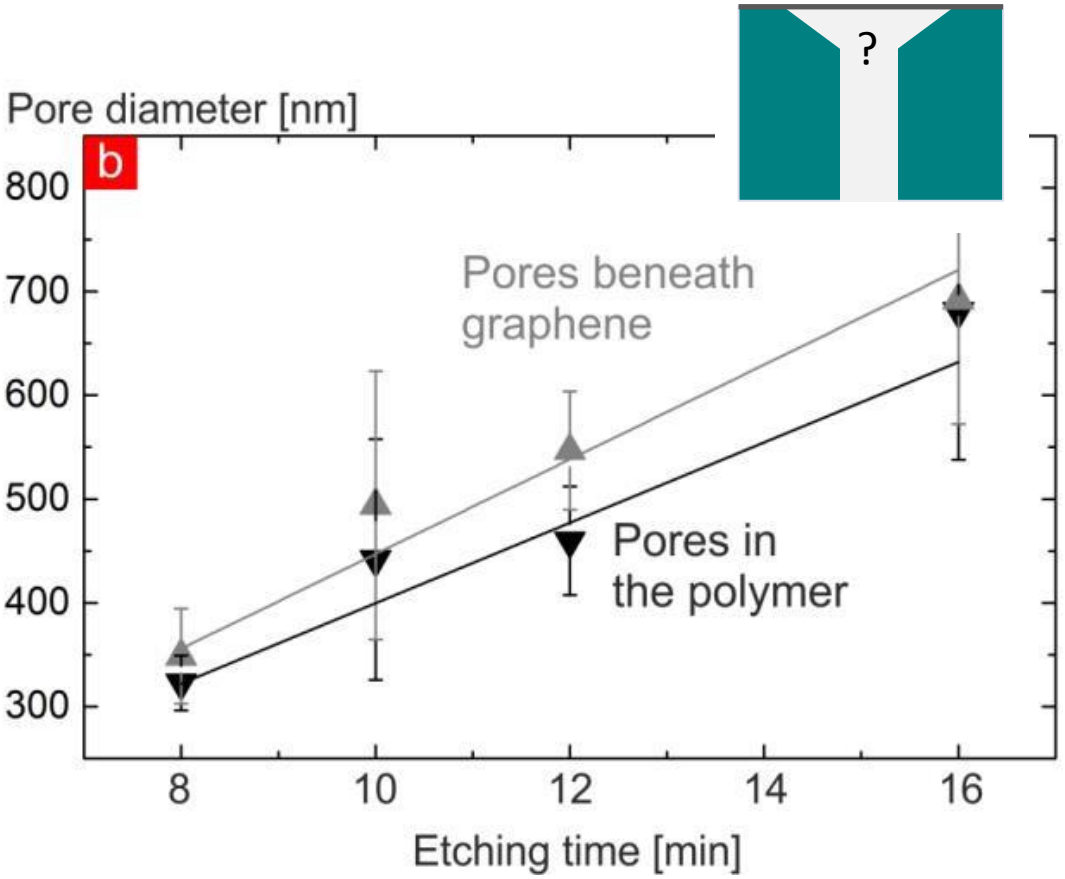
- Robust composite
- Aligned pores by perforation with SHI and subsequent etching
- Assessing separation performance
- Understanding of relevant mechanisms

Towards Ultrafiltration-Membranes



Towards Ultrafiltration-Membranes





Consortium Partners & their Roles

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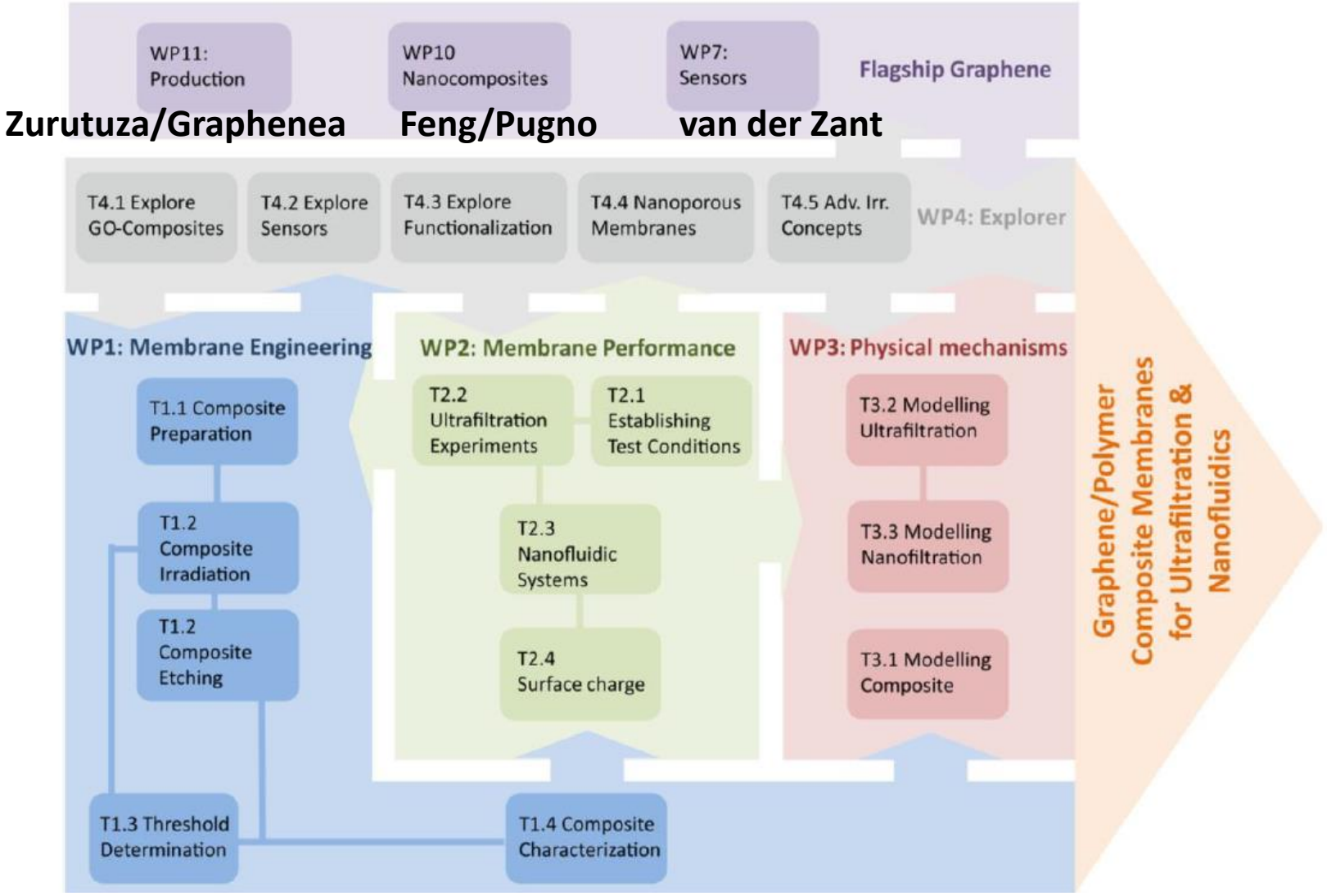
Graphene Composites
M. Schleberger, L. Madauß
UDE, Germany


Ultrafiltration
M. Ulbricht, J. Schuhmacher
UDE, Germany


Irradiation
H. Lebius ENSICAEN, France
M. Karlusic RBI, Croatia


Nanofluidics
M. Gosh, R. Lammertink,
U Twente, Netherlands


Interactions with the Flagship Core Projects



Timing of Workpackages

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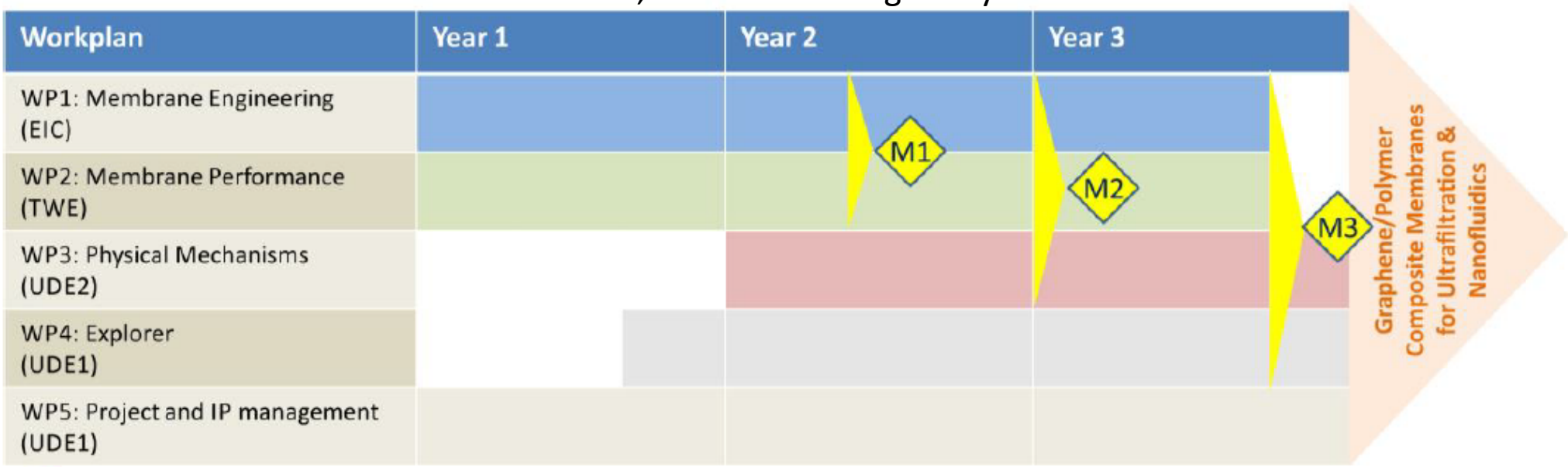
Start: 1.2.2016, Kick-off meeting today



Milestones
M1: Robust graphene/polymer-composite
M2: Lab-scale prototypes of a graphene-polymer composite membranes for ultrafiltration and nanofluidic systems
M3: Design concepts for various graphene-based composite membranes for ultrafiltration and nanofluidics

Communication Platform & Website

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