

Block-copolymer nanostructured silicon loaded with AuNPs for confined space photocatalysis

Sajjad Husain Mir
Advanced Materials and Bioengineering Research Center (AMBER)
Trinity College Dublin

HOST INSTITUTION



Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

PARTNER INSTITUTIONS



FUNDED BY:



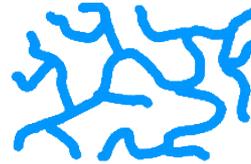
Introduction: Directed Self-assembly

- ✓ Etch Mask
- ✓ Refractivity
- ✓ Magnetism
- ✓ Stability
- ✓ **Plasmonics / Photocatalysts**

Metals NPs



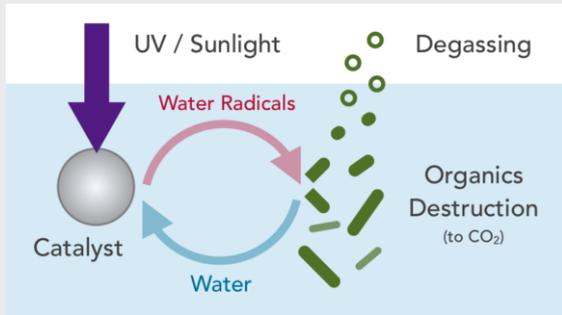
Block-copolymer lithography



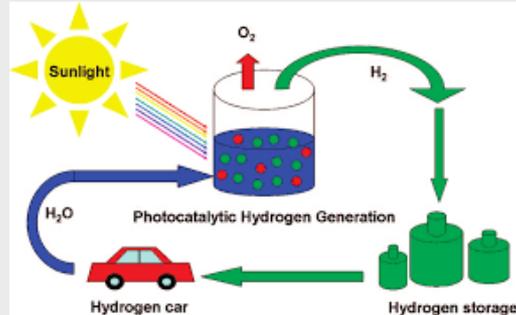
- ✓ Etch Mask
- ✓ solution processibility / self-assembly
- ✓ Cost-effective
- ✓ Wide range of geometries

Photocatalyst heterostructure

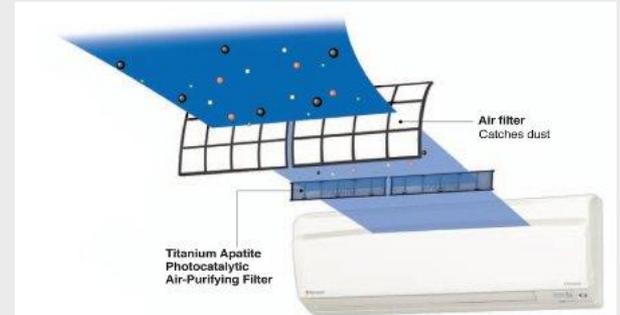
Applications of Photocatalysis



Water purification



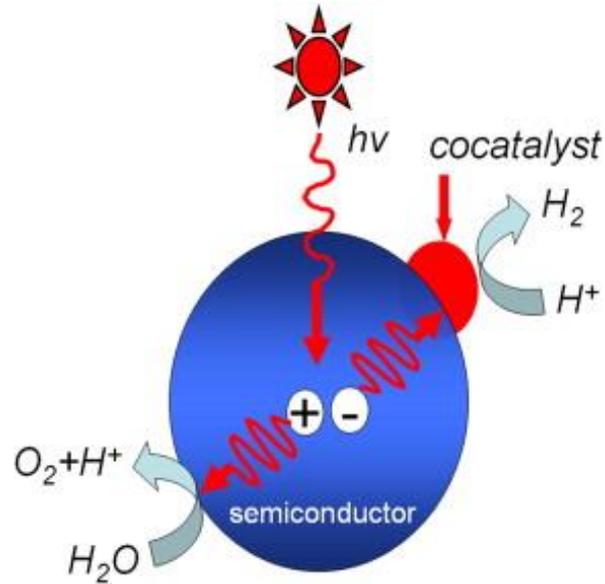
Renewable energy



Air purification

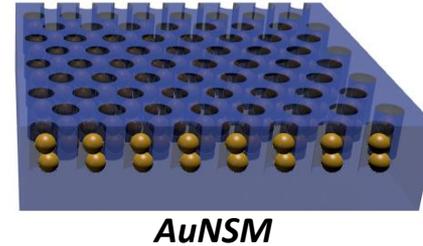


Co-catalyst design



- ✓ Nanostructuring of photocatalyst surface
- ✓ Increase more charge carriers
- ✓ Co-catalyst design for broad solar spectrum

photocatalyst heterostructure (AuNSM)



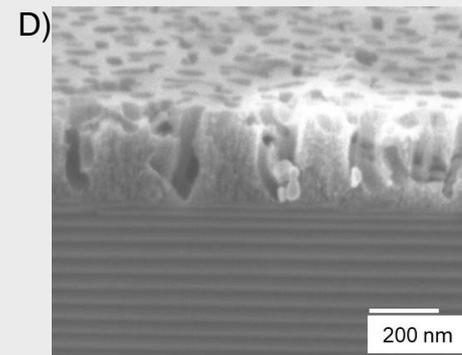
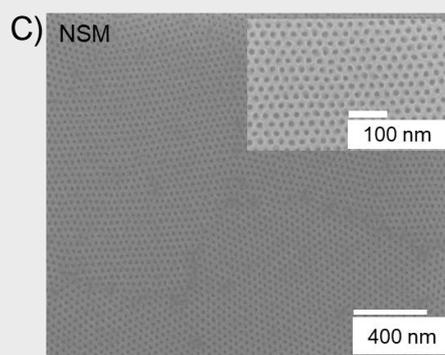
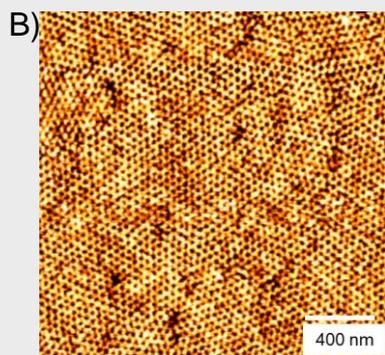
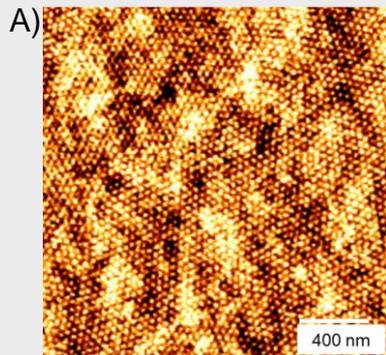
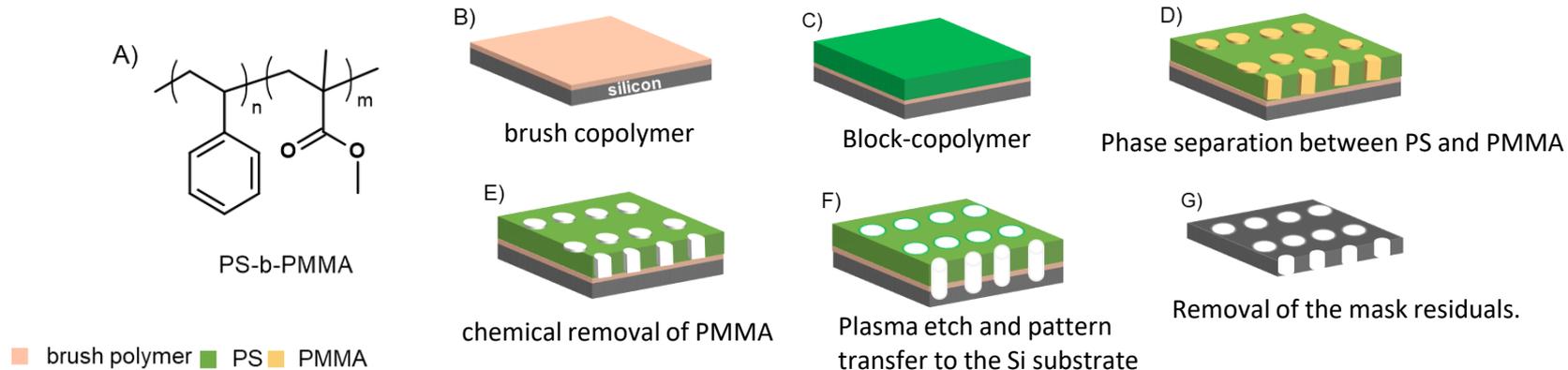
- ✓ Highly efficient
- ✓ Cost effective fabrication
- ✓ Near-field coupling
- ✓ Good charge separation
- ✓ High surface area for reactions
- ✓ Recyclable

Adv. Optical Mater. **2021**, 2002238.



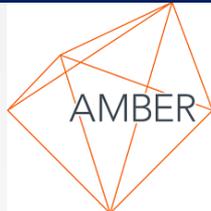
Fabrication of Poly(styrene) Etch Mask

Schematics: Fabrication of NSM



A) PS-b-PMMA thin film as etch mask, B) PS matrix after PMMA removal by RIE-ICP etch, C) etched (NSM) with inset high-resolution SEM image. The pores have a diameter of 25 ± 5 nm and period of 48 ± 2 nm. D) SEM images of the NSM embedded with AuNPs with bright spots indicating AuNPs in the pores (AuNSM).

Acknowledgements



- **Advanced Microscopy Laboratory (AML), TCD**
- **Alan Hydes, Tyndall National Institute**
- **Prof. Igor Shvets and Prof. Cormac for the XPS**

