Dr Iris Nandhakumar

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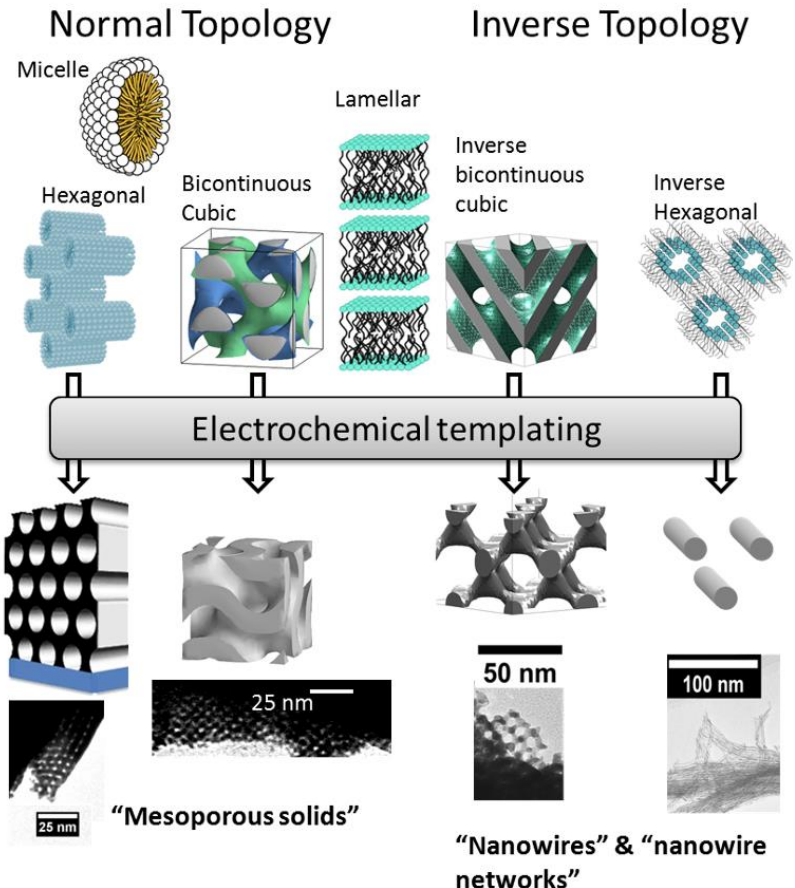
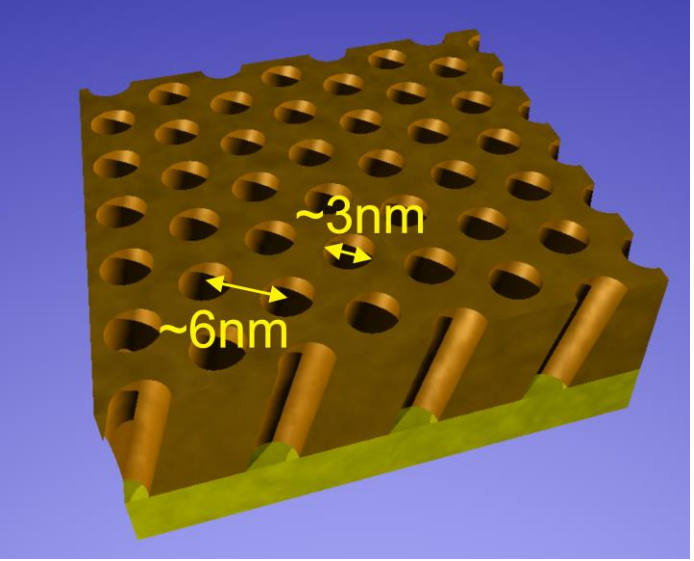
Soft-templating of 3D metamaterials





- Unique 3D nanostructuring
- High quality birefringent semiconductors
- Engineered metamaterials: e.g. CdTe, PbTe, Te…

- 40 % of all the atoms are at or near a surface:
  - Enhanced electronic + optical properties for e.g. solar cells, ultra-fast photodiodes, non-linear optical elements

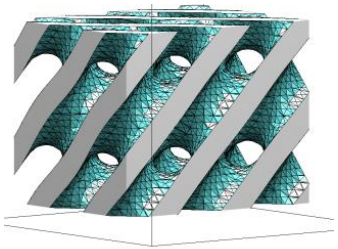
  - Exploration of quantum-size effect

Chem. Comm., Vol. 12, 1374-1375 (2004)
Appl. Phys.Lett., Vol. 86, 011912 (2005)
J. Mat. Chem., 16 (31): 3207-3214 2006

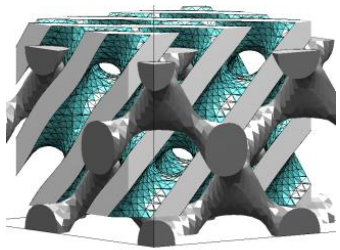
*Electrochem. Comm.*10, 363 (2008)

3D Nanostructured Thermoelectric Metamaterials

Soft Template

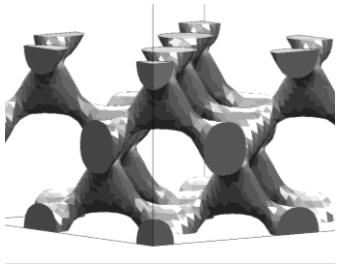


Electrochemical Deposition



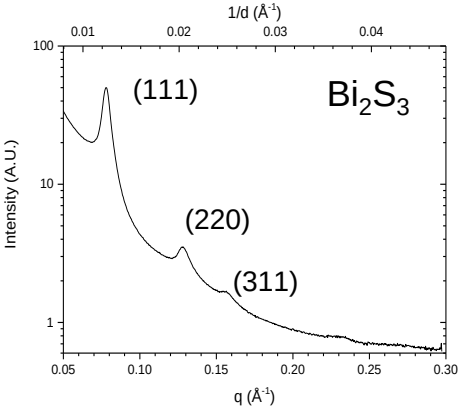
Removal of template

3D Nanostructure



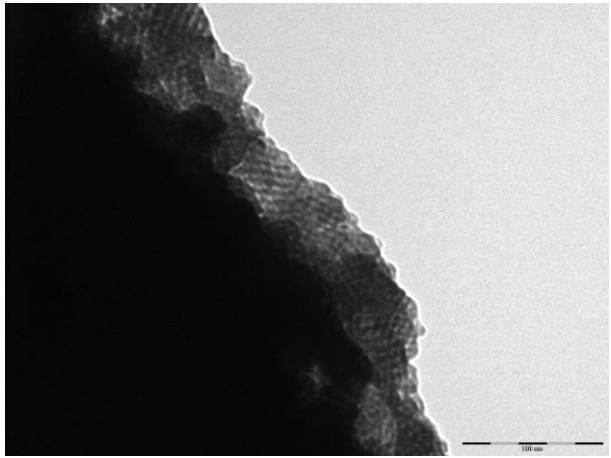
EPSRC EP/T026219/1

SAXS



"Single-diamond"

TEM

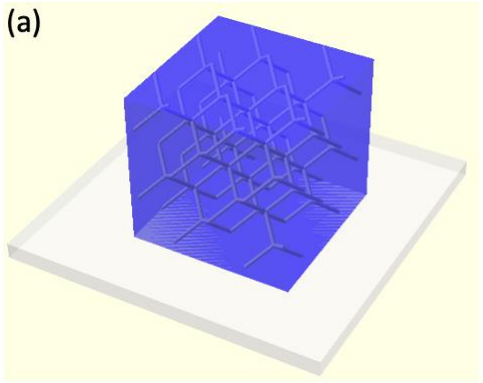


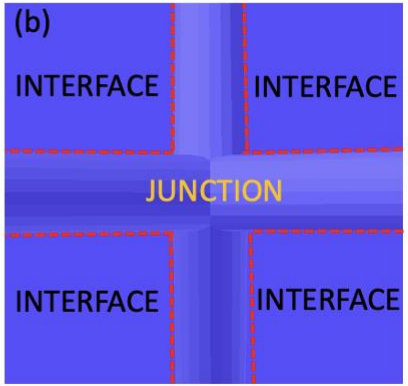
Electrochemistry Communications 97, 56-59 (2018).
Scientific Reports 7, 6405 (2017).
Electrochem. Comm 76, 71-74 (2017).

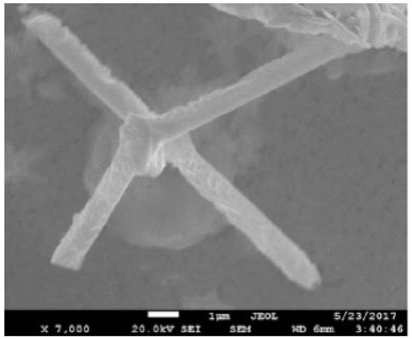
diamond

3D Thermal metamaterials

EPSRC: EP/X012840/1





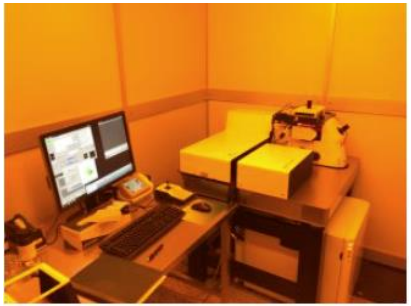


3D Nanoscale Metamaterials: Cardiff University

Principle Investigator

Dr Sam Ladak

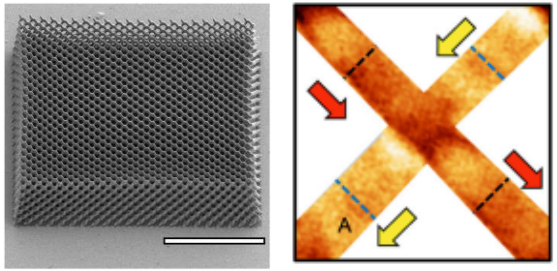
Key Instrumentation



Modified Nanoscribe system:
Sub-100nm feature size
(Unique in U.K.)

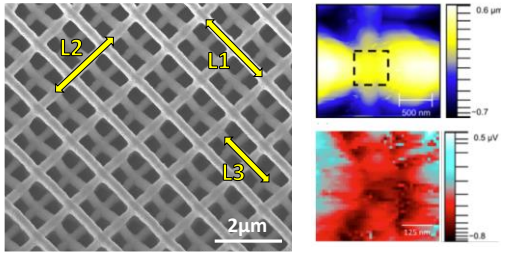
Expertise and interests

May et al. Nature Comms 3217 (2021)



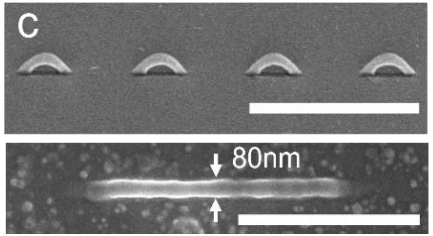
3D Magnetic Metamaterials:
Static and magnonic properties

EPSRC: EP/X012735/1



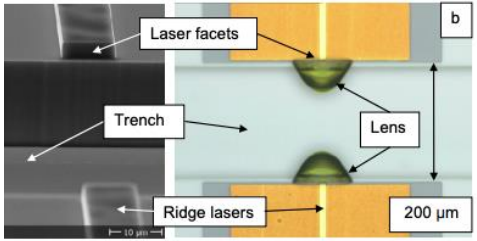
3D Thermal Metamaterials: Controlling thermal conductivity

EPSRC: EP/R009147/1



Low Energy Racetrack Memories
On-chip

Thomas et al. Optics Express 26 13436 (2018)



Lab-on-chip Micro-optics
On-chip micro-lenses

www.ladaklab.com

LadakS@Cardiff.ac.uk

CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

LEVERHULME TRUST

EPSRC

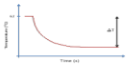
Developing Rapid Mesoscale Thermoelectric Property Measurement System

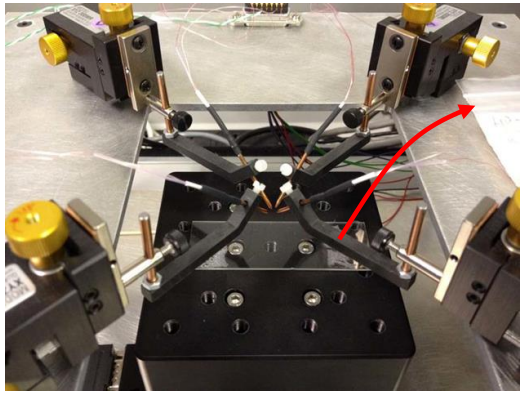
- Gao Min and Matthew Philips, School of Engineering, Cardiff University -

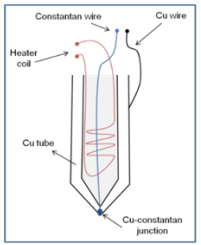
Established Systems @ millimetre scale

Seebeck coefficient: $\alpha_s = \frac{\Delta V}{\Delta T} + \alpha_b$ ±2%

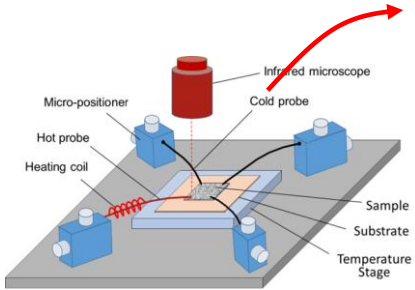
Electrical resistivity: $\rho = \left(\frac{\pi R_{cm}}{\ln 2}\right) \times d$ ±3%

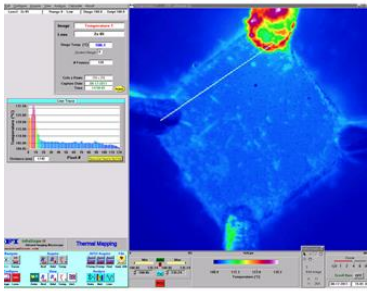
Thermal conductivity:  ±12%

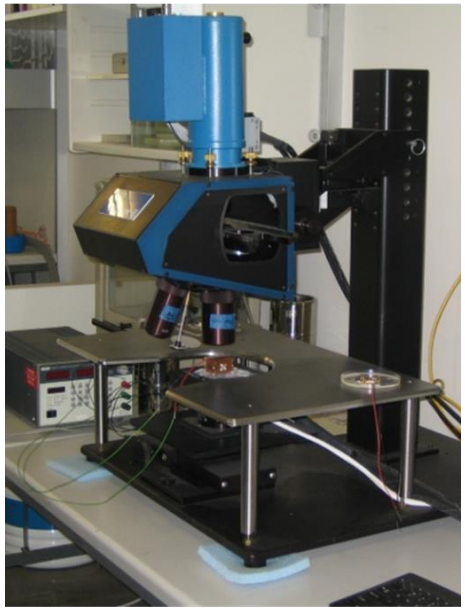




New System on Infrascope @ mesoscale







"Multifunctional probes for high-throughput measurement of Seebeck coefficient and electrical conductivity", *Rev. Sci. Instrum.*, (2014), 85, 043906

"Apparatus for measuring Seebeck coefficient and electrical resistivity of small dimension samples using infrared microscope as temperature sensor", *Rev. Sci. Instrum.*, (2013), 84, 054903