Equipment Name: **Helium-ion Microscope**	**Category:** **C. Particle Characterisation in and ex-situ and/or** **Institute: CRANN, Trinity College Dublin** **Location: CRANN, Naughton Institute, Trinity College Dublin, College Green, Dublin 2, Ireland** **Contact Details of Technology Expert:** **Name, Dr Hongzhou Zhang** **Phone, 353 (0)1 896 4655** **Fax, 353 (0)1 896 3037** **E-mail hozhang@tcd.ie**

Short technology description/Overview:

The Helium-ion Microscope (HIM) is a recent development in the family of charged particle microscopes. A beam of He ions (called the primary beam) is generated, accelerated, and directed onto a sample surface. The interaction between the He ion beam and the atoms of the sample surface produces abundant signals which carry the information of the sample and can be recorded by appropriate detectors. The HIM shows great potential to be a versatile tool with the characterization capabilities comparable to a transmission electron microscope, the convenience of sample preparation as for a scanning electron microscope, and the nanomachinery function better than a Ga^{+} FIB. In terms of the analysis of biological samples, it is proposed that the advantages of the HIM over the other microscopic methodologies include: (1) sub-nanometre resolution (2) efficient charge control (3) small beam damage (4) high depth of field and (5) nano-machining capability. The HIM is therefore promising for imaging and analyzing interfaces of biological samples and nanostructures at the nanometre scale.

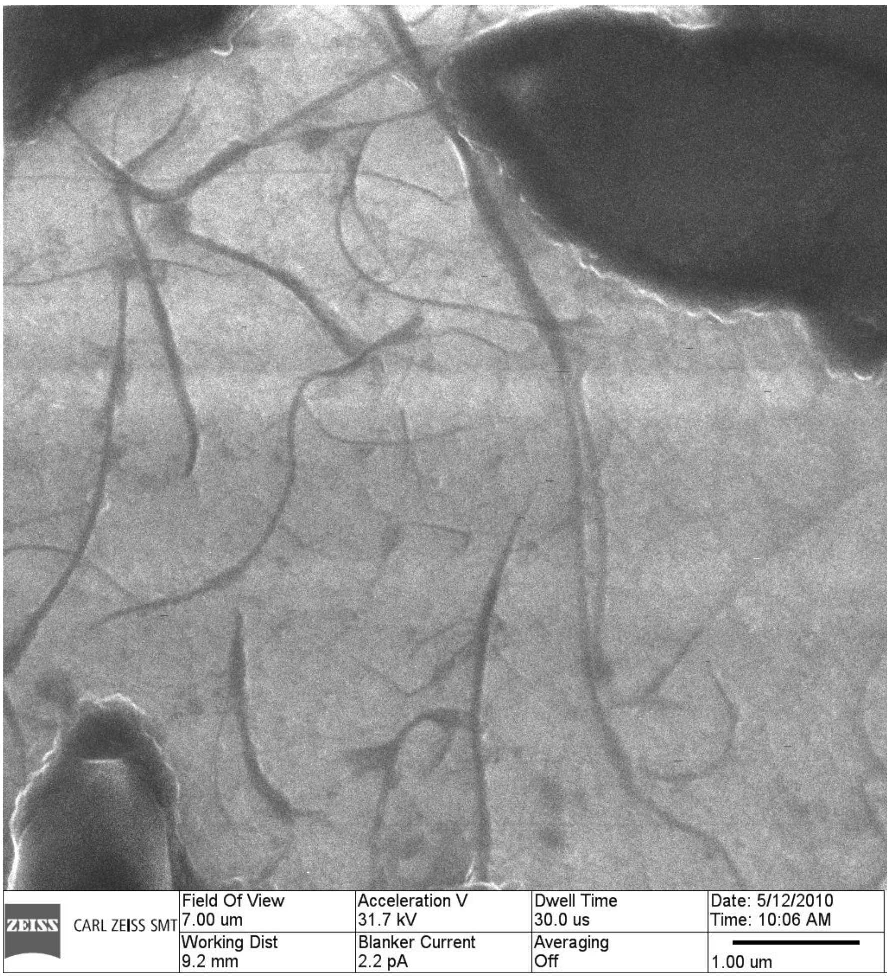
The development of the HIM directly addresses one of the most important issues in the field of nanoscience and nanotechnology, i.e. characterization and modification nanostructures in general and nanobiomaterials in particular at a sub-nanometre scale. The outputs will allow us to add value and intelligence to these materials. In the long term, nano-devices based on the enhanced materials and enabled by the HIM may proceed further to commercialized applications and facilitate the strategic transition of European economy towards knowledge-based and sustainable development.

Stakeholders and end users in Ireland will encompass a number of research institutes as well as Small Medium Enterprises (e.g. SolarPrint Ireland) and Multinational Corporations (e.g. Intel Ireland and Hewlett-Packard) in many industry sectors.

Main Features (Equipment Capabilities):

- Resolution: < 0.75 nm at 45kV
- Field of View: Variable from 1 mm to 200nm
- Energy Spread: 0.25-0.5 eV
- Beam current: 1fA – 100 pA
- Sample size: 50 mm in diameter x 25 mm thick
- Detectors
    - Everhart-Thorley secondary electron detector
    - Energy resolved backscattered ion detector
    - Microchnnel plate detector for backscattered ions

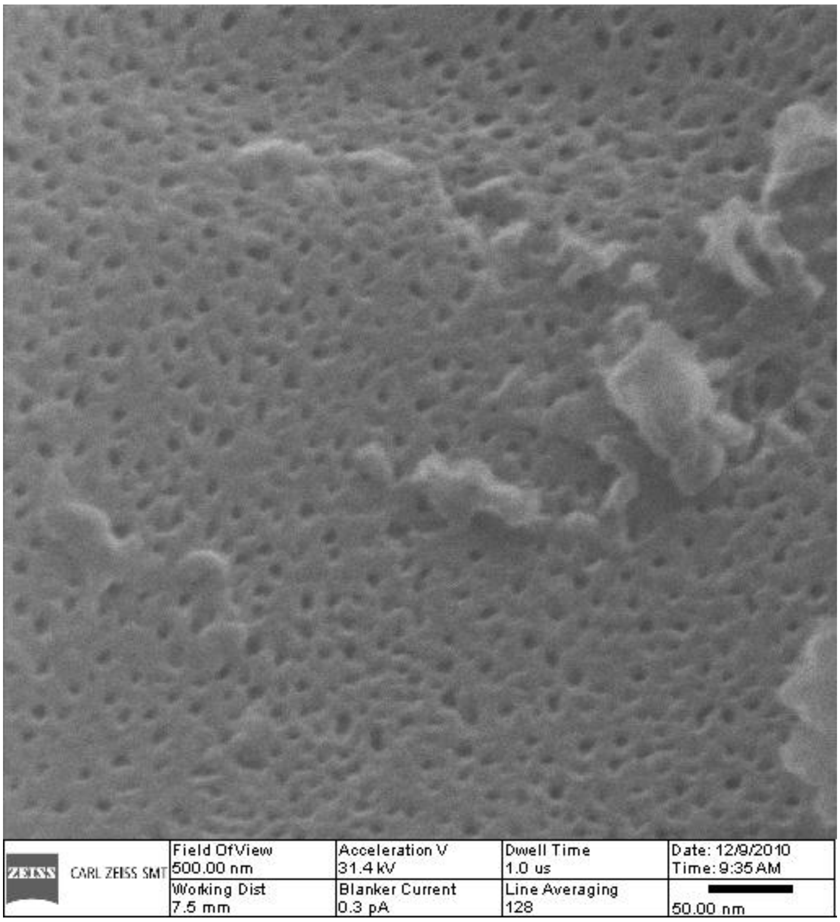
Typical Samples & Images:



Aggregates amyloid and tau protein - precursors for amyloid fibrillation in Alzheimer's disease

(sample: G. Thakur and Prof R. M. Leblanc, University of Miami)

NANO Research Infrastructure



Porous silicon powder

(Sample provided by: Edward Chadwick and David Tanner, University of Limerick)

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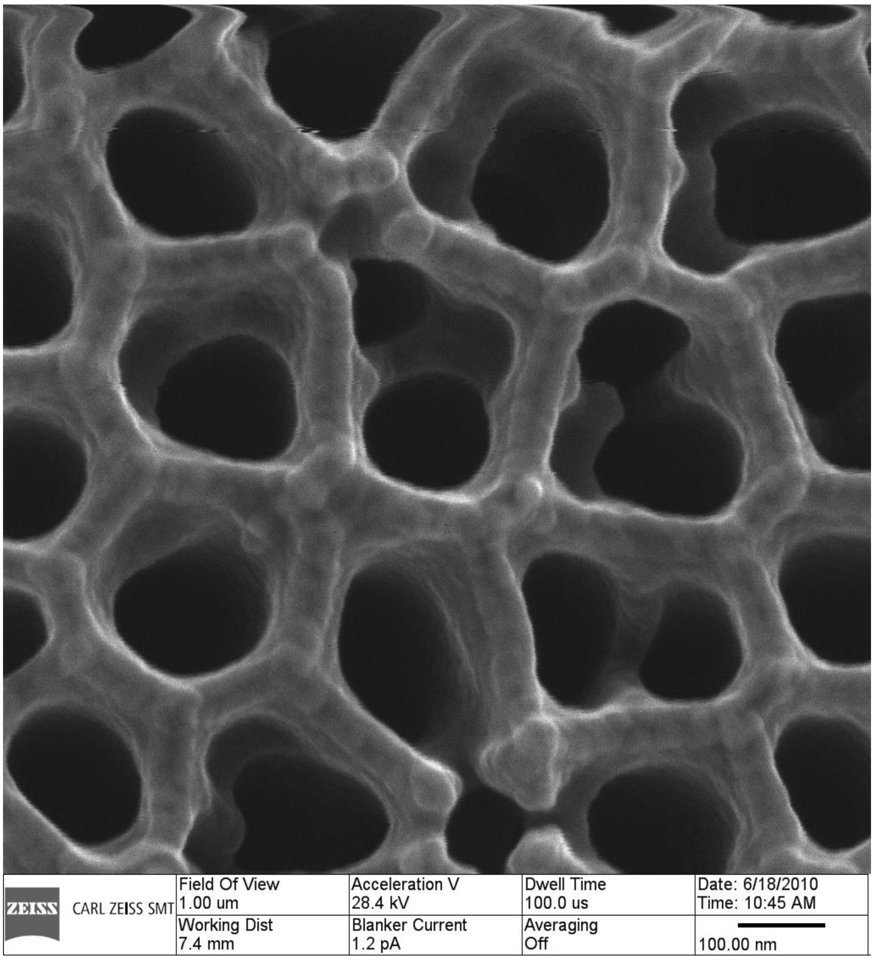
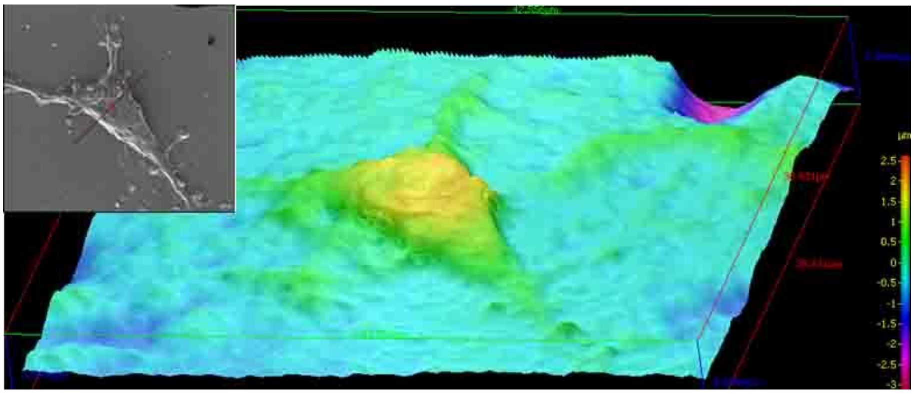


AAO

(Ju Xu, Tyndall)



Cancer cells

(D. Bazou and H. Zhang, CRANN, TCD)

Any further Information: