Canadian Centre for Electron Microscopy provides world-class electron microscopy capabilities and expertise. We are the go-to provider of electron microscopy services and consultation to Canadian industry and researchers working in a broad range of fields. Located at McMaster University, CCEM features state-of-the-art instrumentation and experienced, dedicated staff who are happy to work with you to find solutions to your materials research and development questions.

Bio-medical

The variety of proposed applications for biomedical materials is rapidly increasing. To ensure biocompatibility, the structure and composition of the introduced material, and then characterization of their reactions with targeted tissues and cells must be well understood. Electron microscopy can provide unique visualizations of biomaterials at very high resolution, while analysis of their composition and purity allows confident assessment of their compatibility.

We can provide

- 2D and 3D imaging and data reconstruction
- chemical analysis, mapping, 3D reconstruction
- analysis of beam sensitive materials

> “Electron tomography... provides not only superior nanoscale resolution to X-ray-based analyses, but also compositional contrast sensitive enough to discern bone from the implant, and ultrastructural features within the bone itself.”
>
> **X. Wang et al.**
> ACS Biomaterials Science & Engineering 3 (2016) 49-55

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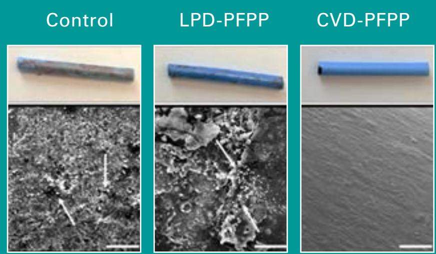
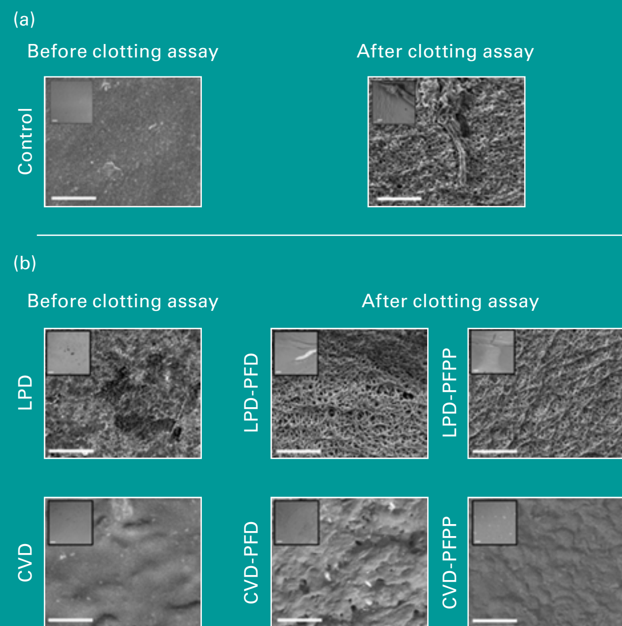
Assessing surface modification techniques to prevent thrombosis on catheters

The development of surface coating techniques to circumvent clot formation on implanted medical devices such as catheters can have an enormous impact on implant success, overall patient well-being and healthcare costs. SEM imaging was used to examine the effects of applied coatings on implant surface topography and to investigate the effectiveness of the coatings to repel blood coagulation protein deposition in tests.



Above: Catheter coatings of perfluoroperhydrophenanthrene (PFPP) through liquid phase deposition (LPD) and chemical phase deposition (CVD) were compared after exposure to whole blood. Platelet adhesion (arrows) and clot formation can be seen with the SEM on the control and the LPD-PFPP treated catheters, but not on the CVD-PFPP treated catheters. Scale bars = 50 µm.

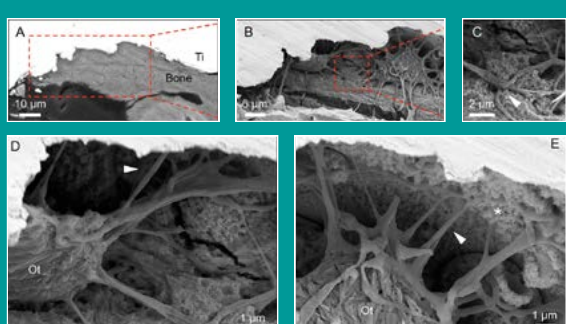


Left: Internal catheter topography can be compared before and after salinization, followed by a plasma clotting assay using the SEM. After salinization treatment, the CVD catheters have a smoother surface than LPD catheters. LPD and the control catheters show protein layers on surface from plasma exposure, while the CPD catheters do not. The surface coverings are revealed at higher magnifications, as compared to the low magnification inset images. Scale bars = 10µm insets images, Scale bars = 1µm large images.

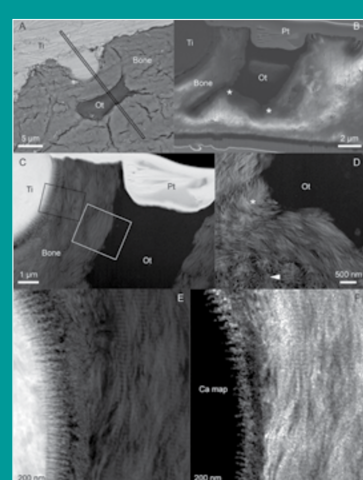
REFERENCE Badv, M., Jaffer, I.H., Weitz, J.I., Didar, T.F. An omniphobic lubricant-infused coating produced by chemical vapor deposition of hydrophobic organosilanes attenuates clotting on catheter surfaces. *Sci Rep* 7, 11639 (2017). https://doi.org/10.1038/s41598-017-12149-1

Investigation of osteocyte networks adjacent to nanotextured titanium implants in human

While bone formation is relatively well understood, the behaviour of bone at an implant interface is not. The role osteocytes play in loading-based bone remodelling is under study. In samples involving 4-year-old titanium dental implants, osteocyte activity extended to the implant surface and multiple osteocyte-implant connections were observed, suggesting an osteocyte contribution to long-term osseointegration.



Area of new bone formation, with both mineralized and unmineralized areas close to the implant surface. In high-resolution, numerous canaliculi from the osteocytes extend toward the implant surface, making intimate contact with the nanotextured oxide layer.



(A) Osteocyte lacuna in close proximity to the implant surface. TEM sample site outlined. (B) TEM specimen during ion beam milling, a protective platinum layer is deposited. (C) TEM image showing highly aligned bone tissue. (D) Bundles of collagen fibrils run parallel to the osteocyte surface, some (arrowhead) run into the plane of the image. (E) Higher magnification shows highly regular collagen banding adjacent to the implant surface. (F) Calcium map of the area seen in E.

REFERENCE High-Resolution Visualization of the Osteocyte Lacuno-Canalicular Network Juxtaposed to the Surface of Nanotextured Titanium Implants in Human, Furqan A. Shah, Xiaoyue Wang, Peter Thomsen, Kathryn Grandfield, Anders Palmquist, ACS Biomater. Sci. Eng. 1 (2015) 305–313