

Materials Science

Metallurgy

Creganna-Tactx Medical-Tactx Medical-Tactx Medical operates a state of the art Materials Laboratory. The laboratory is equipped with advanced characterization equipment and staffed by a team of experienced metallurgists and materials scientists.

Examples of research activities include the investigation, development and improvement of the fine-scale microstructure of technologically important materials. Through this work, the team develops innovative materials for advanced delivery device solutions. In addition, the laboratory staff offers materials consultancy to both in-house engineers and Creganna-Tactx Medical-Tactx Medical-Tactx Medical customers.

Technical resources include metallographic facilities, light optical microscopes, a scanning electron microscope suite, a range of mechanical testing instruments and advanced heat treatment capabilities.



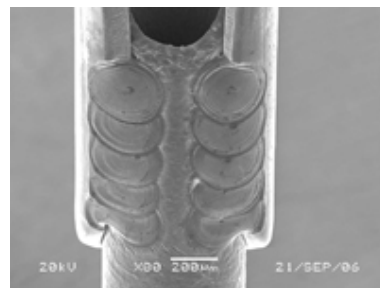
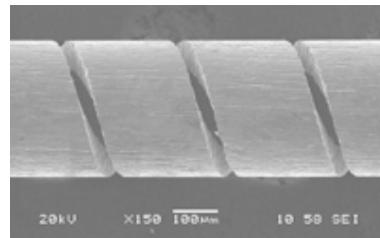
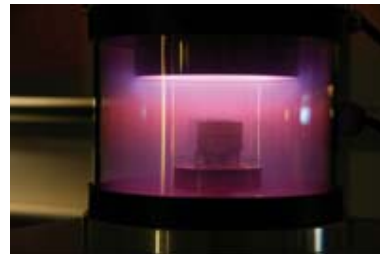
Microscopy & Microanalysis

Creganna-Tactx Medical-Tactx Medical-Tactx Medical's materials laboratory is equipped with a comprehensive set of equipment for the preparation and examination of metallic, polymeric, ceramic and composite materials.

Light optical microscopes are used for general microstructure characterization. Resolution spans from about 380 to 780 nm depending on the microscope with resolution limited by diffraction of the incident light. In order to see smaller, a scanning electron microscope is used.

In a scanning electron microscope, an electron beam is scanned across the surface under investigation. The impact of the beam with the surface generates a cascade of electrons and X-rays that are scattered in all directions. The amount of electrons generated at the surface, and their energy, depend on the topography and on the elements that the analyzed material consists of. Thus, both topographic and elemental information can be obtained. X-ray micro analysis enables qualitative and quantitative chemical composition analysis.

To carry out electron microscopy on polymeric and non conducting specimens, the specimens are either analysed under a low vacuum mode or they are first coated using a high resolution sputter coater. The coater uses a magnetron sputtering system designed to ensure fine grain even coating (Au) over a wide area and enables thin coatings of 2-3 nm to be achieved. The application of a conductive surface coating eliminates charging effects experienced in the SEM with non conducting specimens.



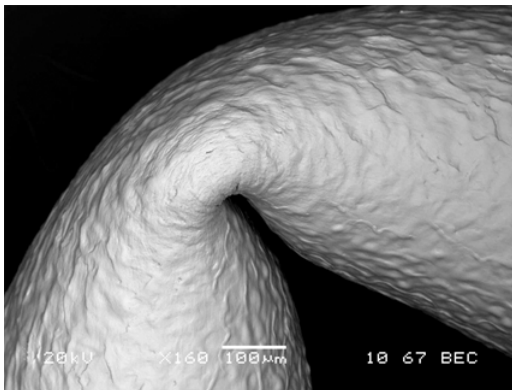
Microscopy assessments include:

- Weld zone assessment
- Surface analysis
- Fractography
- Grain structure characterization
- Precipitate and Inclusion analysis
- JEOL JSM-6480LV Scanning Electron Microscope fitted with Oxford Instruments INCA x-sight X-ray detector

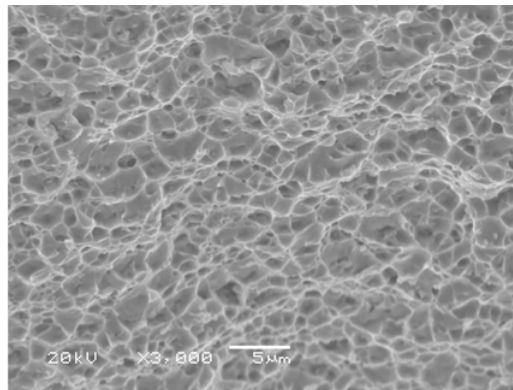
SEM Instrument Data

- Resolution HV-mode: 3.0 nm at 30kV
- Resolution LV-mode: 4.0 nm at 30kV
- Acc. Voltage: 0.3 to 30kV
- Magnification: 5 – 300,000 X
- Stage: 100 x 125 mm
- Motorized: 5-axis standard

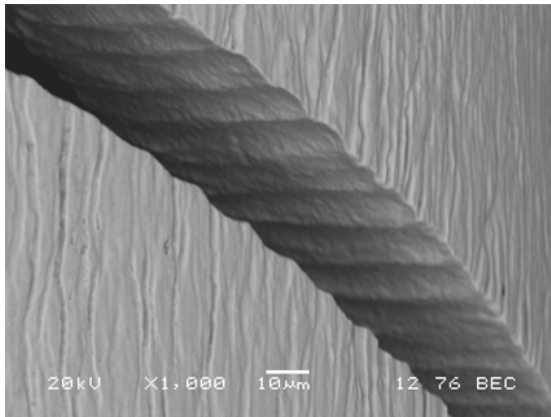
Sample SEM Images



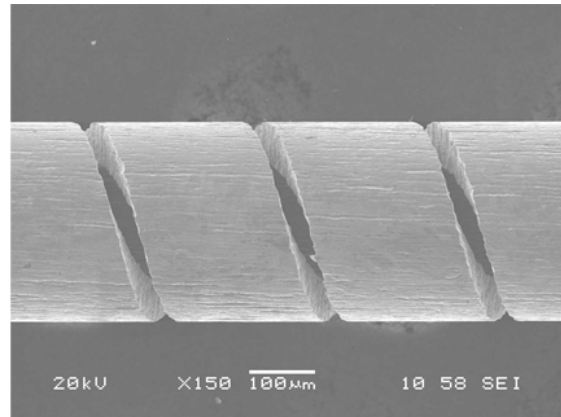
Hypotube kink



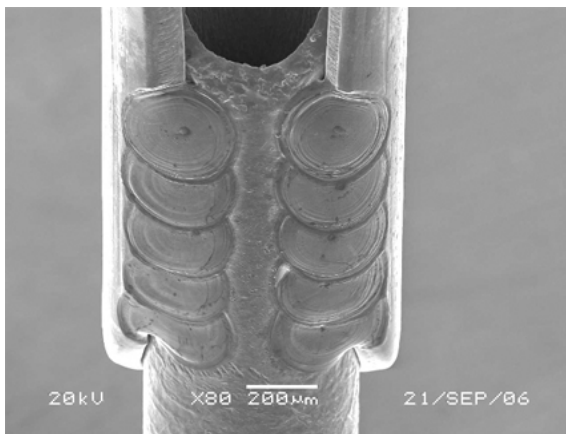
Ductile Fracture



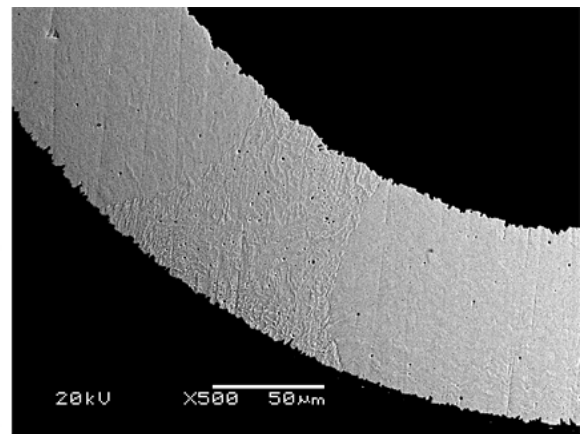
Cut and cleaned kerf



Spiral Cut Hypotube



Spot Welding



Hypotube Weld Line

Energy Dispersive X-ray Detector Data

- Qualitative and quantitative chemical composition analysis
- Chemical analysis from a spot (<5 mm) or a selected area
- Compositional mapping from a selected line or area
- Light Element Window allowing detection of elements from B upwards

Mechanical Testing

A range of mechanical testing is conducted by the materials science group.

These comprehensive tests in combination with microstructure analysis enable the metallurgy team to optimize materials for a customer specific application or to develop innovative new material solutions.

Mechanical testing includes:

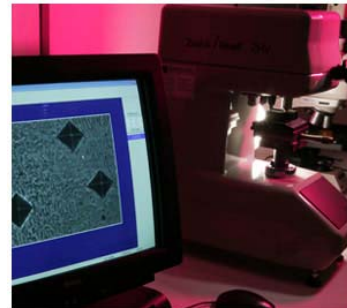
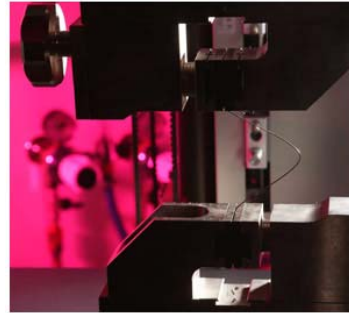
- Tensile & compression testing
- Column strength testing
- Bend testing
- Kink testing
- Micro hardness testing
- Track and 3 dimensional push testing

Mechanical Testing Equipment

- Micro Vickers Hardness Tester
- Measurement resolution 0.1 mm
- Test forces from 10 to 2000 gf
- ISO 6507 and ASTM E92 standard

Universal Mechanical Testing Machine

- 10 kN load frame
- 2.5 kN and 200 N load cells
- Speed range 0.0005 – 2,000 mm/min
- Specimen centering
- High resolution extensometer calibrated to meet EN ISO 9513



Heat Treatment

In-house facilities: Heat treatment is a process where metals or their alloys are subjected to a controlled treatment by heating and cooling to alter their physical and mechanical properties without changing the product shape.

High Vacuum & High Pressure Furnace

- Maximum operating temperature: 1350 °C
- Working temperature–vacuum heating: 750 – 1350 °C
- Working temperature–convection heating: 150 – 750 °C
- Temperature uniformity: ± 5 °C
- Max. cooling gas pressure: 6 bar
- Operating Vacuum: 10–5 mbar range



Split Three Zone Tube Furnace

- Maximum operating temperature: 1200 °C
- Three independently controlled heat zones to ensure excellent thermal uniformity
- An 8-channel thermocouple data logger
- Inert gas purging facility



Stress Relieving Retort Vacuum Furnace

- Maximum operating temperature: 800 °C.
- 3 thermocouples to monitor load temperature, load over-temperature & element temperature.
- Rotary vane vacuum pump & an inert/reducing gas purging.
- Data logging facility to record temperature

Ultra-Cold Chest freezer (Cryogenic treatment unit)

- Minimum operating temperature: – 80 °C
- Controlled cooling and reheating
- Temperature uniformity: ± 5 °C

Polymer Science

The Creganna-Tactx Medical Innovation Centre has a dedicated team of polymer scientists who research and develop new polymer based solutions for use in medical device access and delivery systems.

Areas of research and development include complex polymer solutions such as PEEK, and advanced polymer composites.

In collaboration with external specialists, the team undertakes polymer research including:

- XPS – X-Ray Photoelectron Spectroscopy
- SSIMS – Statics Secondary Ion Mass Spectrometry
- DSIMS – Image depth profiling, 3-D imaging
- Polymer orientation and texture measurement
- SAXS – Small angle X-Ray Scattering
- Microscopy and mapping
- DSC – Differential Scanning Calorimetry
- TMA – Thermomechanical Analysis
- TGA – Thermogravimetric Analysis
- DMTA – Dynamic Mechanical Analysis
- FTiR (Fourier Transform Infra-Red Spectroscopy) and Raman Spectroscopy
- Nuclear Magnetic Resonance (NMR)
- Mechanical testing – creep, tensile, flexural, compression, shear, biaxial, indentation and fracture