Material Engineering and Processing

RESEARCH

Overview

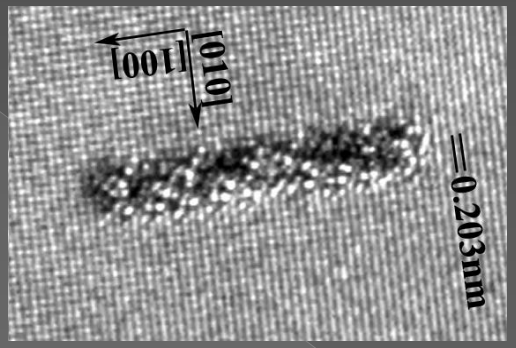
2011

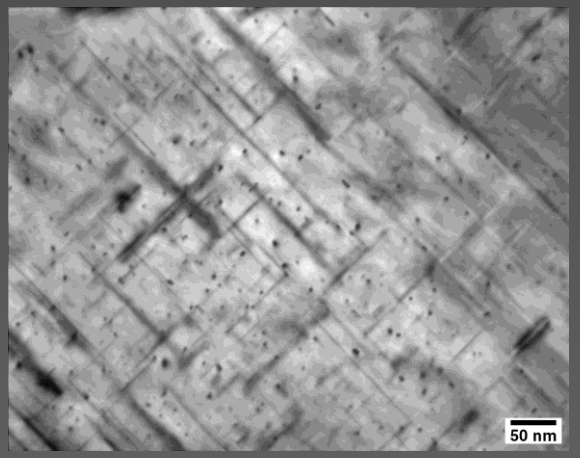
RESEARCH DIRECTIONS

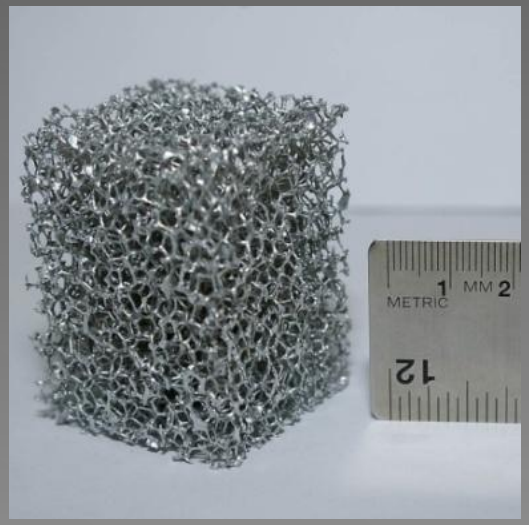
1. ***Extending*** **the properties and limitations of materials**
   - **E.g. composite materials and intermetallicalloys**
2. ***Developing*** **new materials, materials processing techniques and materials joining techniques**
   - **E.g. solidification, metal working, welding and joining, surface treatments**

Professor Shahrzad Esmaeili

- **Ultrafine-grained precipitation hardening Al alloys.**







- **Metallic foams and metal-polymer hybrid systems.**
- **Modeling of process-structure-property relationships in adv. metallic materials.**

Professor Carolyn Hansson

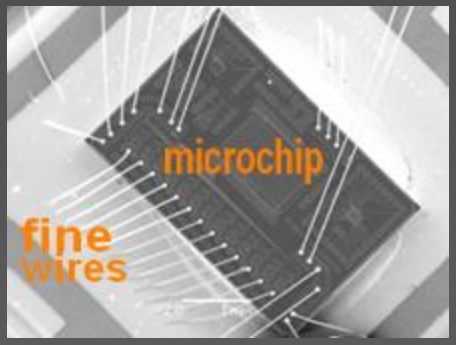
Students Monitoring Corrosion of rebar for Ministry of Transportation

- **Durability of Concrete**
- **Corrosion, Erosion and Wear**

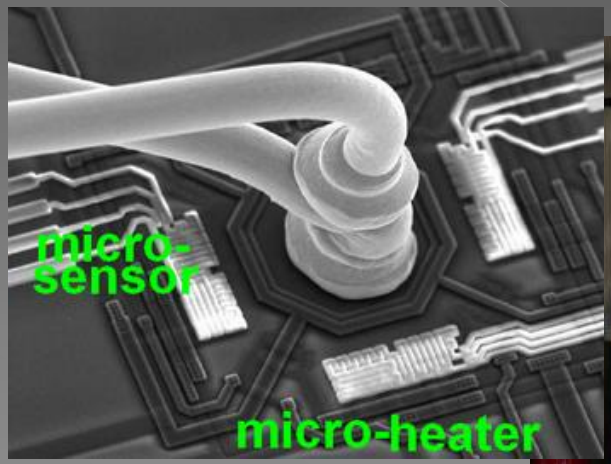
Steel rebar corrosion under Bridge St. bridge in Kitchener

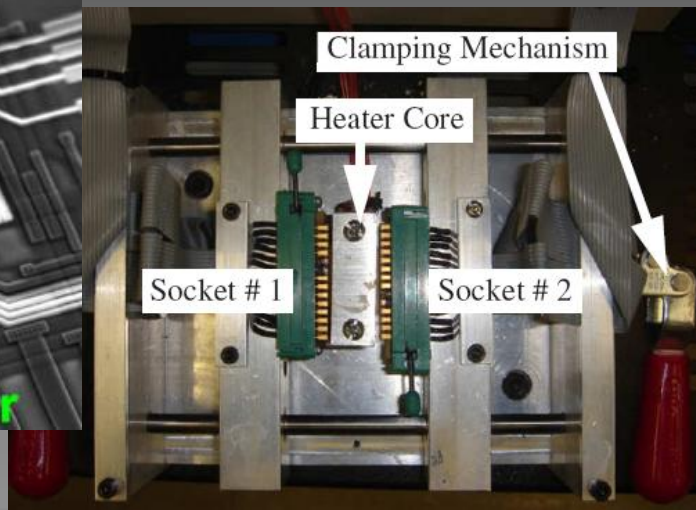
Professor Michael Mayer

- Thermosonics for Microwire Joining

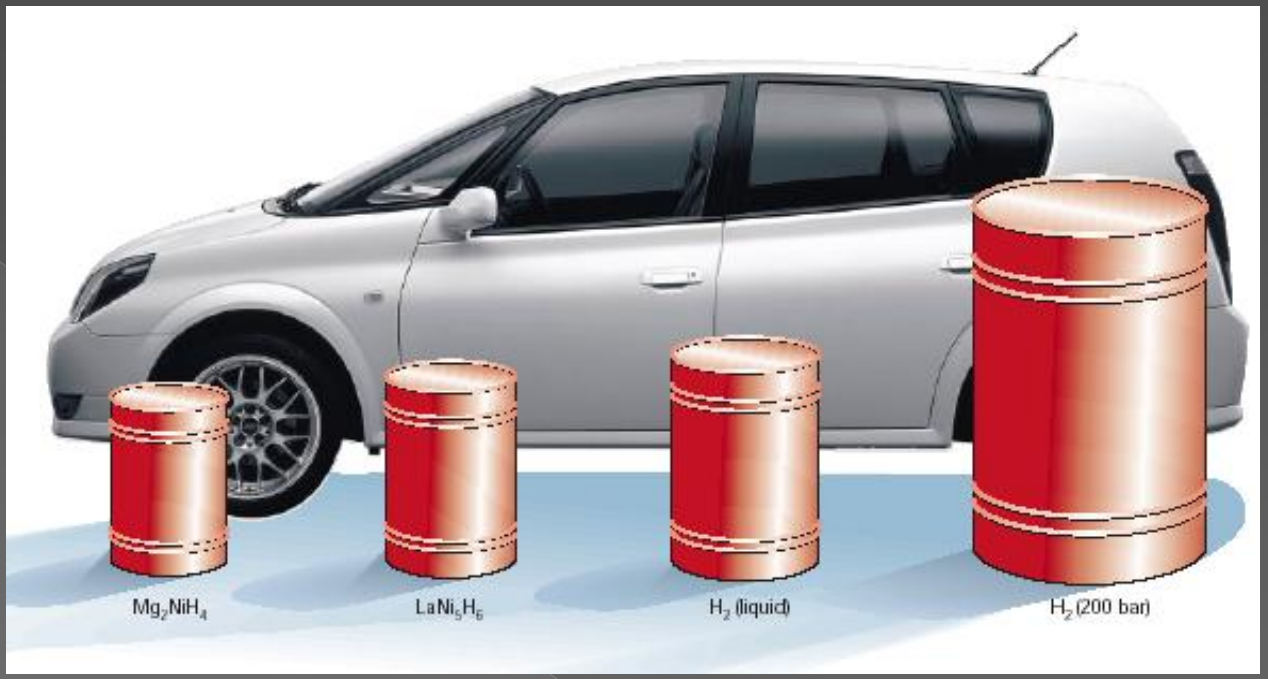


- Micro and mini heaters and for Reliability Testing
- Micro-Joining
- Microsensors Microactuators





Professor Robert Varin

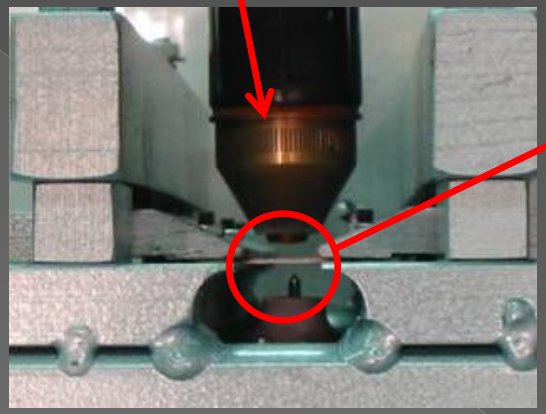


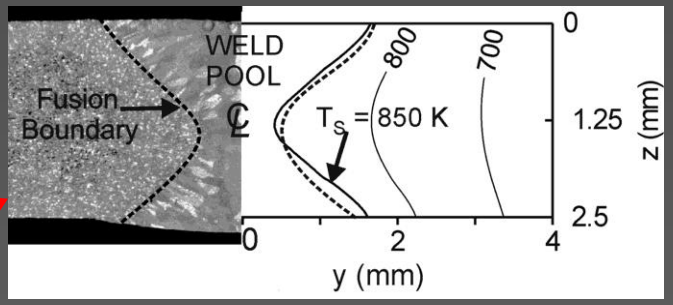
Volume of 4 kg of hydrogen compacted in different ways, with size relative to the size of a Toyota Prius [Toyota press, 33rd Tokyo Motor Show, 1999; L. Schlapbach and A. Zűttel, Nature 414 (2001) 353-358]

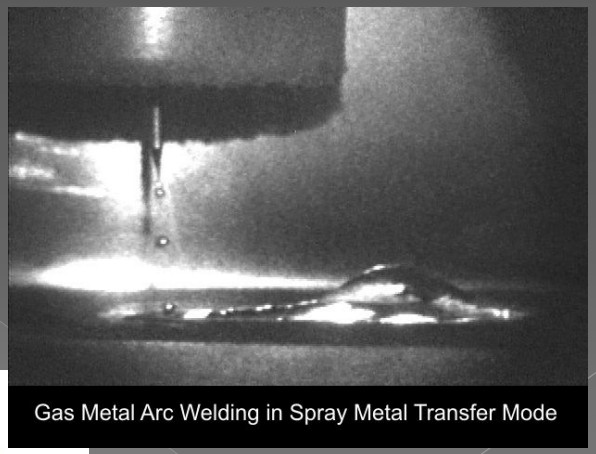
- **Nanostructured and Amorphous Materials for Hydrogen Storage, Superconducting and Magnetic Applications**
- **Intermetallics and Advanced Composites for Aerospace and Automotive Applications**

Professor Dave Weckman

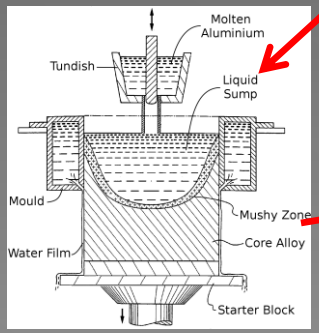
- **Laser Welding and Laser Materials Processing**
- **Arc Welding Processes; GTAW, GMAW, VPPAW, DSAW, etc.**

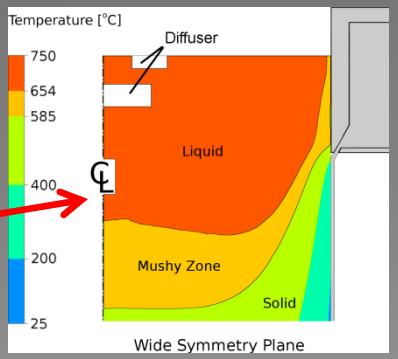


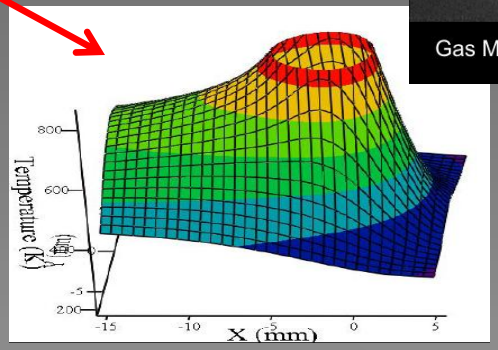



Gas Metal Arc Welding in Spray Metal Transfer Mode

- **Thermofluids numerical modelling of various welding and continous casting processes**

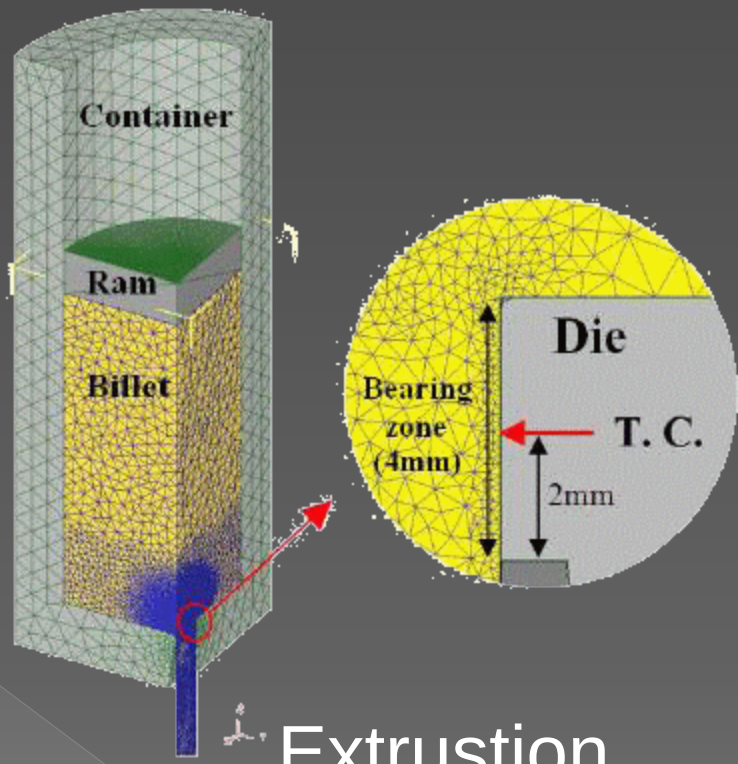




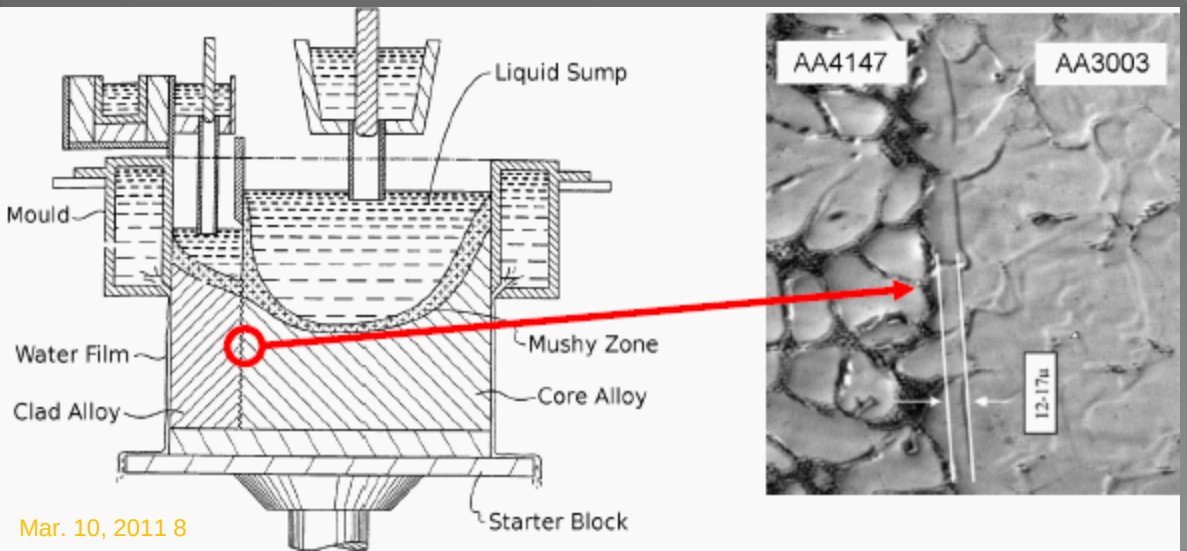


Professor Mary Wells

- Manufacturing Process Modelling
- Hot Deformation of Metals
- Casting of Light Metals
- Boiling Water Heat Transfer
- Microstructure/processing models



Extrustion …

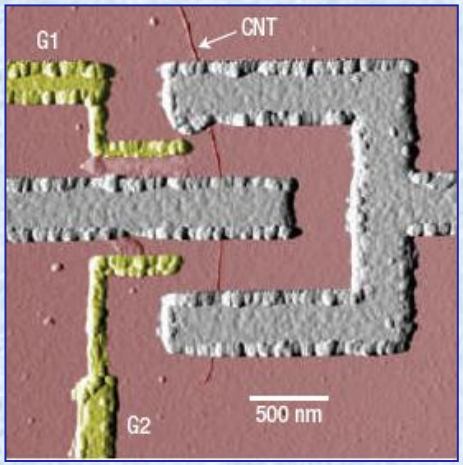


Co-casting …

… of Aluminum Alloys

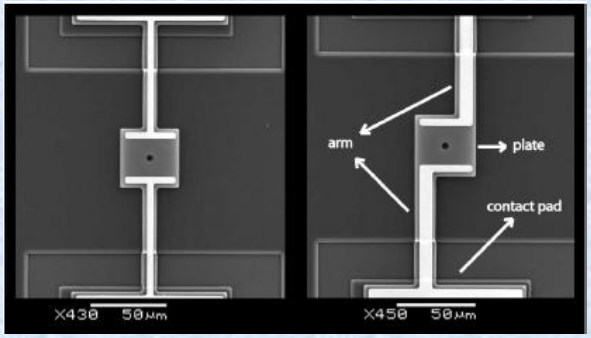
Professor Mustafa Yavuz

Nano-scale Superconducting Hybrid Electronics:



Nano-Bio-Sensors (SQUIDs) Made out of Carbon-nano-tube (CNT) Used for Cancer Diagnosis & E-coli Detection

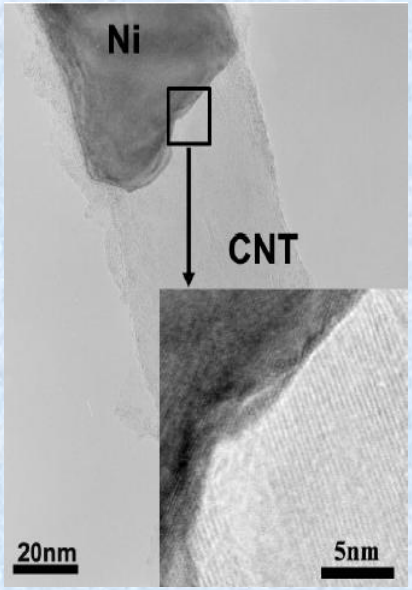
Nano/Micro-Electro-Mechanical Systems (N/MEMS):



MEMS IR sensors for image analysis

Nano-junctions and joining:

Electron Microscopy image of a Ni/CNT nano-junction, used in ballistics.



Professor Norman Zhou

Joining, incl. micro-/nano-joining

- Brazing and soldering
- Laser joining
- Magnetic pulse welding
- Resistance welding
- Ultrasonic wire bonding

Industrial Applications

- Auto-body
- Electronics
- Medical implants
- Aerospace turbin blades
- Water treatment