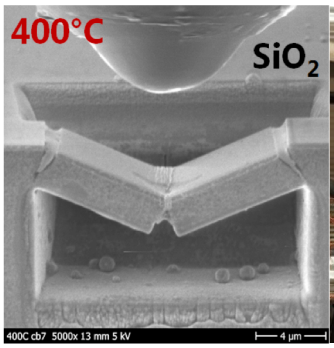
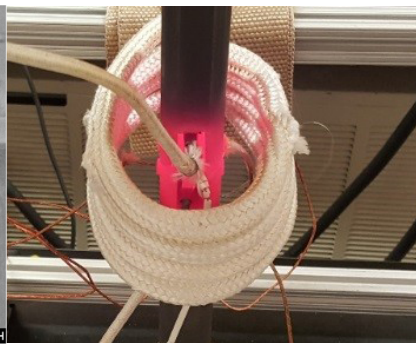
Material Performance: Advanced Mechanical Testing and Simulation

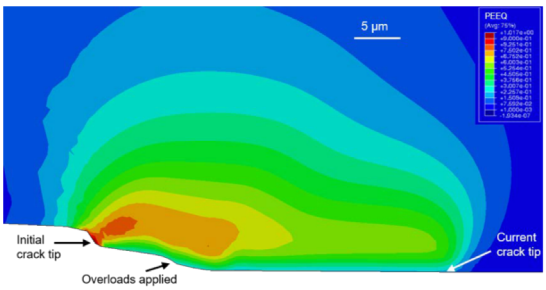
School of Mechanical & Manufacturing Engineering

TECHNOLOGIES

- Material performance in extreme environments
  - Nano- and Micro-scale testing up to 600°C
  - Macro-scale testing from cryogenic to 1500°C
  - Corrosive and oxidizing environments, vacuum, inert gas, aqueous & biological conditions
- Modelling and simulation:
  - Novel crack propagation model development (overloads, spectrum loading, creep-fatigue)
  - Discrete damage model development
- Conventional alloys and novel materials (high-entropy alloys, ceramics, metallic glasses, intermetallics, bio-inspired materials, etc.)







COMPETITIVE ADVANTAGES

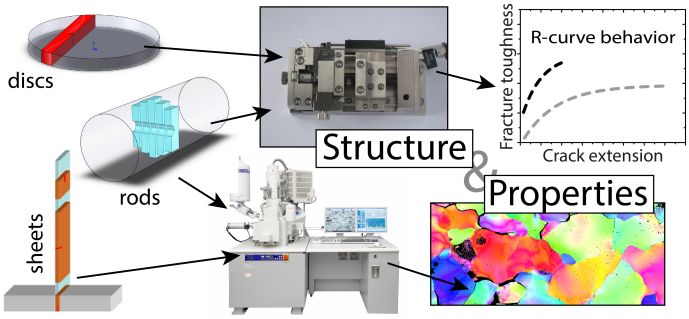
- Comprehensive failure mechanisms and lifetime predictions
- *In situ* mechanical testing
- Advanced crack growth modelling
- Novel models of damage evolution
- Bio-inspired design (e.g., natural armor materials)

PROJECTS and APPLICATIONS

- US Department of Energy – Superalloys
- Hereaus Group – Additive Manufactured Metals
- Intel Corporation – Solders
- SPEE3D – Additive Manufactured Metals
- PCC Structurals – Superalloy Castings
- ESCO Corporation – Steel Welds
- Plansee SE Corporation – Refractory Metals
- Glassimetal Inc. – Metallic Glasses
- Liquidmetal Technologies– Metallic Glasses
- PLATIT AG – PVD Coatings

FACILITIES AND INFRASTRUCTURE

- **Nano-/micro-scale:** Alemnis *in situ* nanoindenter with intrinsic displacement control
- **mm-scale:** Deben micro-test for ex situ and *in situ* deformation and property measurements
- **Macro-scale:** Instron multi-axial testing frames
- **Modelling and simulation:** Discrete modelling of deformation, damage, failure, crack propagation modelling with overloads, spectrum loading



EXPERTS

Prof. Jay Kruzic – Fracture and fatigue of advanced engineering materials & lifetime predictions

Dr. Bernd Gludovatz – *Ex situ & in situ* characterisation of mechanical performance

Dr. James Best – Small-scale testing & mechanical analysis of advanced materials

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