(AMMRC)

Advanced Manufacturing and Mechanical Reliability Center

2016-2017 Academic Year

CASE SCHOOL OF ENGINEERING
CASE WESTERN RESERVE UNIVERSITY

About

The Advanced Manufacturing and Mechanical Reliability Center (AMMRC) was established in 1987 to provide advanced manufacturing (e.g. deformation processing, extrusion, forming, etc.) and mechanical characterization (e.g. mechanical testing, reliability testing, fatigue, etc.) expertise to the CWRU campus, medical, industrial, legal, outside university, and government laboratory communities.

The Center, housed in the Charles M. White Metallurgy building, currently maintains equipment valued in excess of $4.5M and has been accessed by the local, national, and international communities.

The CWRU campus community can access the facility via the use of a valid CWRU university account number that will be charged at an internal rate for machine time, including set up and any technician time involved. Long term testing can be provided at pro-rated charges in consultation with the Center Director.

Arrangements can be made to train users on the equipment and reserve time for equipment use by contacting the Center co-director. Outside (i.e. non-CWRU) users can access the facility via a number of different mechanisms by contacting the Center Director. Remote access and/or monitoring of testing is possible.

Advanced Manufacturing and Mechanical Reliability Center (AMMRC)
Case Western Reserve University
Charles M. White Metallurgy Building
ammrc.case.edu

Deformation Processing Equipment

Advanced Deformation Simulator MTS Model 311.31

- Hot/warm/cold forming
- Multiple deformation sequences
- 110 Kip forging actuator
- 220 Kip indexing actuator
- Maximum loading rate: 120"/s
- "Large" samples (e.g. 5" diameter)
- Emulates industrial processes
- Large strain deformation

Advanced Forming Apparatus MTS Model 866.725

- Forming limit diagrams
- 10" Punch stroke
- 11.8"/s Punch velocity
- Dynamic punch force: 105 Kip
- Static punch force: 150 Kip
- Clamp actuator: 157 Kip
- Various dies: 27" wide, 40" depth

Fenn 14" Rolling Mill

Extrusion

- Innovare, Inc. LES Explorer Series
  - Maximum temperature: 900°C
  - 100,000 lb force
  - Billet diameter: 0.5"
  - Extrusion dies: 1/4", 5/16", 3/8"
  - Extrusion rate: 0.5"/min-1.0"/min
- Advanced Metalworking System
  - 400,000 lb force apparatus

Impact Testing: 240 ft-lb Capacity

Wiedemann-Baldwin; Tinius Olsen

- Dynatup Instrumentation package

Servo-Hydraulic Equipment

Capabilities
- Tension, compression, fatigue
- Load, stroke, or strain control
- Low T and high T testing
- HCF/LCF
- Fatigue crack growth
- Fracture toughness
- DCPD —FTA software

MTS Machines
- 50 Kip (2): High alignment grips
  — Temperature: -125°C to 600°C
- 20 Kip
  — Temperature: -125°C to 225°C
- 10 Kip: Horizontal machine
- 3 Kip: Fully reversed bending

Instron Machine
- 5 Kip
- Temperature: –125°C to 600°C

Electro-Mechanical Equipment

Instron/MTS Model 1361
- Capable of 1 µm/hr test rate
- Temperature < 1500°C
- Load, stroke, or strain control

Universal Testing Machines

Instru-Met/Instron Model 1125
- Tension, compression, torsion
- Temperature: 25°C to 1600°C
- 100 kN capacity

Instru-Met/Instron Model 1130
- Tension, compression
- Temperature: -125°C to 200°C
- Pneumatic grips
- 5 kN capacity

Microscale Testing Equipment

EnduraTEC
- Tension, torsion, cyclic
- 5 lb, 25 lb, 50 lb, 500 lb load cells

Nikon QM Hot Microhardness
- Vickers or Knoop indenter
- 50 g —1 kg
- T < 1000°C

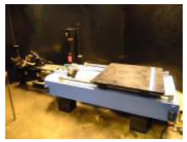
Universal Flex Bending Fatigue
- R = -1
- Test frequency: 1— 17 Hz
- Mandrel sizes: 1— 24 mm
- Automatic break detection

Rotating Bending Fatigue
- R = -1
- Test frequency: 60 Hz
- Wire diameter: 0.05 —1.0 mm
- Automatic break detection
- High cycle fatigue

Positool Model 100
- Bend radius: 2—127 mm

Positool Model 401
- Bend radius: 7.24 – 76.2 mm
- Accommodates wet testing

High Pressure Testing



MTS Machine
- Pressure up to 700 MPa, Ar gas
- Tension, compression
- 30 kN load cell

Innovare LES Explorer
- Tension testing, isopressing
- Pressure up to 2 GPa, oil
- Hydrostatic extrusion
- T < 300°C

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The Center is capable of mechanically evaluating and deformation processing materials that range in size scale from the micrometer range up through bulk quantities. This unique facility enables mechanical characterization at loading rates as low as one micrometer/hour (i.e. rate of fingernail growth!) up through impact (e.g. 3-4 meters/sec) at temperatures ranging from -196°C (i.e liquid nitrogen) up to 1400°C.

Monotonic as well as cyclic fatigue testing is possible via remote control and/or monitoring. In addition, evaluations of mechanical behavior and processing with superimposed pressures up to 2 GPa are possible. Deformation processing is conducted on novel forging, forming, and extrusion equipment. Materials systems that have been investigated span the range of organic and inorganic materials, including metals, ceramics, polymers, composites, electronic materials, and biomedical materials systems.

Director:
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