## CURRENT PROJECTS

### 1) Numerical Work:-

- Liquid flow in vibration suppressor tanks (tuned liquid dampers).

- Marangoni convection and slag-line erosion in steel making operations.

- Flow in complex enclosures and ribbed channels (electronic cooling applications).

- Complex flows in automotive torque converters.

- Heat transfer in heat treat operations using inverse conduction analysis.

### 2) Experimental Work:-

- Optimization of thermal processing operations using statistical modeling methods (e.g., Artificial Neural Networks).

- Development of predictive tools for the heat treatment of metal parts.

- Gas and Liquid jet quenching (rapid cooling).

- Optimization of grind hardening operations.

## CURRENT INDUSTRIAL PARTNERS

- McMaster Steel Research Center

- General Motors Corp.

- Members of McMaster Heat Treating Consortium:-
1. NITREX Metal Treating
2. VAC AERO International
3. ABERFOYLE Heat Treaters
4. EXACTATHERM Ltd.
5. A & M Heat Treating
6. INDUSTRIAL HEATING
7. METEX Heat Treating
8. H & S Heat Treating

- Niagara Machine Products Inc.

- LANXESS Inc., Sarnia, ON

- GERDAU AMERISTEEL, Whitby, ON.

- Beltech Engineering

## McMaster University
### ENGINEERING

# THERMAL PROCESSING LABORATORY
## (TPL)

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# RESEARCH INTERESTS

Both Experimental and Computational investigations incorporating fundamental and applied research in the field of Thermal Engineering.

## GENERAL AREAS OF INTEREST

- Computational Fluid Dynamics (CFD) and Heat Transfer.
- Prediction of Microstructure, Internal Stresses, and Distortion during Heat Treating operations.
- Development of Algorithms for moving and free boundary problems.
- Boiling heat transfer associated with liquid jet impingement cooling.
- Convection heat transfer in complex enclosures.
- Gas and liquid jet cooling.
- The use of Artificial Neural Networks in optimization of thermal processing operations.

Multi-Purpose Heat Treating Furnace

# THERMAL PROCESSING LABORATORY

## MISSION

The development of research projects in co-operation with industrial partners and funding agencies with emphasis upon needs and opportunities in the Canadian market.

## MAIN OBJECTIVES

- Offer R&D facilities, expertise, and technology for the thermal processing industry.
- Commit to developing and investigating the best solutions for Canadian industry.
- Assist industrial partners to solve immediate problems and help develop long-term R&D strategies.
- Join industry and academia together to find innovative, adaptive, and cost-effective solutions for industrial problems.

# FACILITIES AND RESOURCES

## MULTI-PURPOSE FURNACE

A multi-purpose furnace suitable for a wide range of heat treating operations, featuring: temperature rating= 400-1750 ºF (200-955 ºC), direct and indirect firing systems, with and without protective atmospheres, large working area 72 (w) x72 (l) x 36(h) inches, with and without air recirculation and temperature uniformity of ±10 ºC.

## QUENCH SYSTEMS

- Liquid quenching both spray and immersion quench capabilities.
- High –Velocity air quench system.
- Spray quench system using multiple jets with different nozzle sizes and a wide range of jet velocity.

## COMPUTATIONAL SOFTWARE PACKAGES

- ANSYS-CFX™.
- DEFORM 3D™ and DEFORM-HT™ (Heat Treat).
- ANNS PREDICTOR™ and SIMCA™.