

## 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



# 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 °F (200-955 °C), 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  $\pm 10$  °C.

### 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™.