

## RESERACH PROJECTS

### Computational and Experimental Studies: -

1. Modeling of fluid flow, heat transfer, and materials microstructure in the following materials processing operations:-
  - Additive manufacturing processes
  - Melting and solidification
  - Metal forming operations
  - Heat treatment processes in batch and continuous furnaces
  - Ablation casting using impinging jets
2. Development of accelerated cooling systems using impinging gas and water jets.
3. Development of enhanced boiling heat transfer surfaces using EDM.

## CURRENT INDUSTRIAL PARTNERS

- General Motors Corp.
- Chrysler and Ford
- 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, Ontario.
- Beltech Engineering
- Pioneer Engineering



## THERMAL PROCESSING LABORATORY (TPL)

**Director**  
**Dr. Mohamed S. Hamed,**  
**P.Eng.**  
**Professor**

Department of Mechanical Engineering  
 McMaster University  
 1280 Main St. W, Hamilton  
 Ontario, Canada L8S 4L7  
 Office: JHE 203  
 Lab: JHE 101 and 107  
 Email: [hamedm@mcmaster.ca](mailto:hamedm@mcmaster.ca)  
 Voice: (905) 525-9140 x26113

<http://mechfaculty.mcmaster.ca/~hamedm>  
 2019

## RESEARCH INTERESTS

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

### GENERAL AREAS OF INTEREST

- Experimental and computational fluid dynamics (CFD) and heat transfer.
- Multi-scale modeling of transport phenomena involved in materials processing and manufacturing technologies.
- Boiling Heat Transfer



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) x 72 (l) x 36(h) inches, with and without air recirculation and temperature uniformity of  $\pm 10$  °C.

### FLUIDIZED BED AND 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.
- Fluidized bed heat treating facility integrated with a water quench system.

### COMPUTATIONAL TOOLS

- In-House CFD Codes
- ANSYS-CFX™.
- LS-Dyna.
- Flow 3D
- ANNS PREDICTOR™.