

## Completed project

### Research Programs

Development of an Analytical Tool for Part Load Design and Temperature Control Within Loaded Furnaces and Parts

#### Research Team:

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#### Focus Group:

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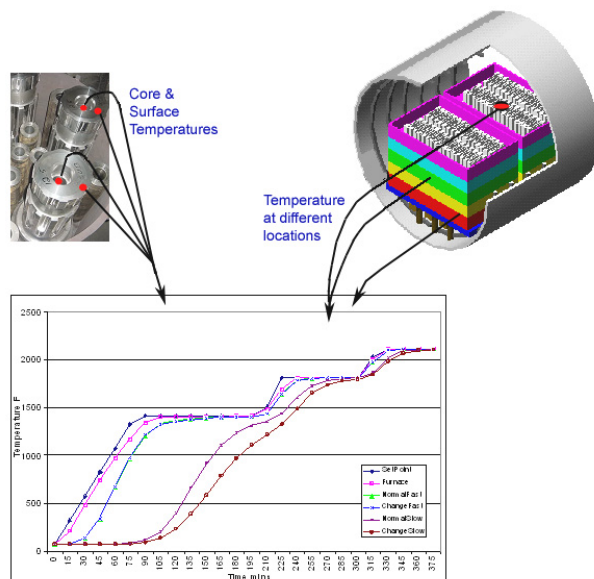
The objective of this project is to develop a computer software tool for modeling and simulating the heat transfer processes in loaded furnace. For given part information and furnace condition, when the part load and thermal schedule are specified, the temperature profile can be estimated for parts in different locations in furnace. Therefore, the part load and furnace temperature control can be optimized with ensured quality and cycle time.

A computer-aided heat treatment planning system for batch furnace (CAHTPS-BF) has been developed. CAHTPS-BF is a powerful software that simulates heating of the parts at different locations inside a furnace. The simulation results are based on our hybrid mathematical model utilizing finite difference methods & empirical equations. The various inputs required for the simulation are the workpiece specifications, furnace data, part load pattern, and the thermal schedule. The simulation results help the user to change the part load patterns, change thermal schedules, increase or decrease the part load and simulate the effects of such changes. With these simulations we can reduce the cycle times, improve the quality of parts by assuring uniform heating and save energy by efficient use of the furnace.

#### CAHTPS-BF features

1) An accurate temperature profile prediction in furnace with different parts and part load.

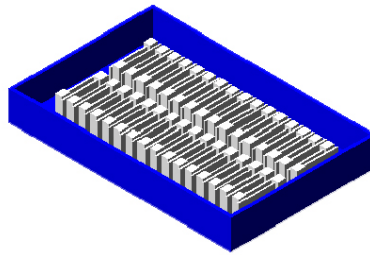
- Software can predict the temperature of every workpiece
- Ability to determine surface & core temperatures, especially for large workpieces
- Capable of handling multiple parts / layers in 3-D as well as different fixtures
- Can simulate under vacuum and different atmospheres



2) Ability to simulate various load patterns including complex random loads

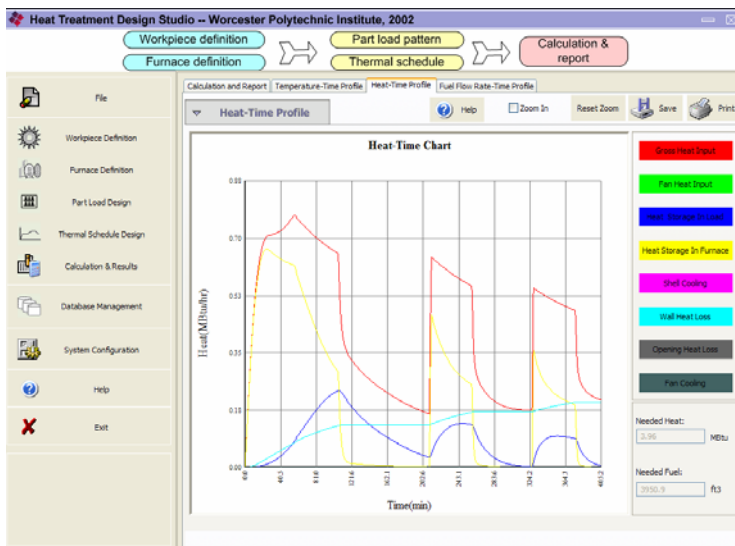
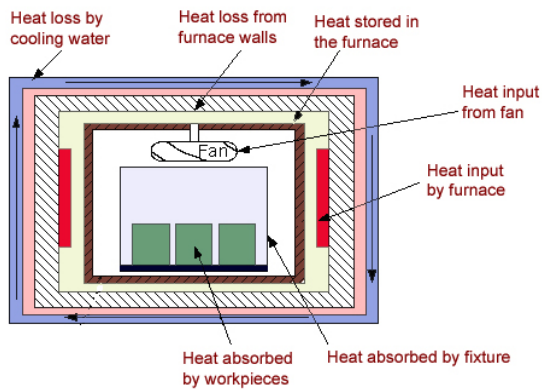
- Can handle both arranged and random load patterns
- Ability to simulate the effects by varying the load pattern, thermal schedule and PID control

- Determine the slowest and the fastest heating parts for a given load pattern



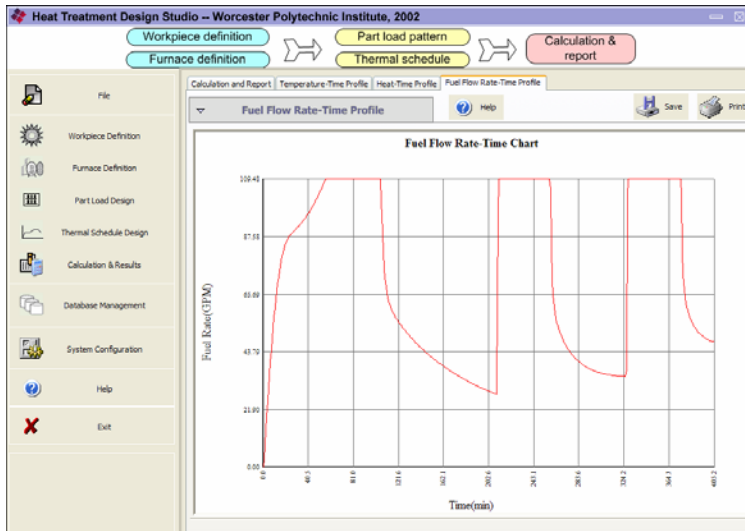
### 3) Ability to calculate several important heat terms

- Predict the heat required for the load under different conditions
- Plot the heat stored in the furnace and the load as a function of time.
- Calculate the different heat losses from the furnace.
- Capability to simulate the effect of using different fixtures



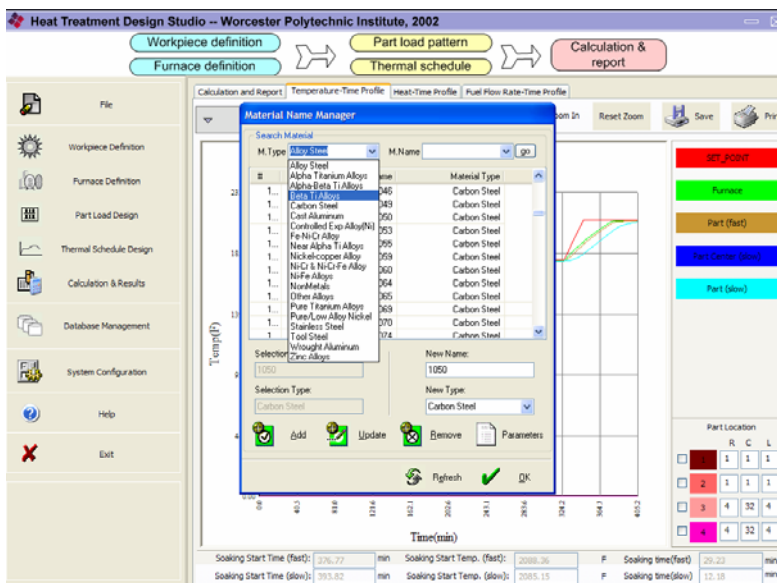
#### 4) Predict fuel flow rate

- Determine the fuel required as a function of time, for better control of furnace performance.



#### 5) Comprehensive Database

- A comprehensive database system with more than 500 materials and several widely used furnaces help the users to use the software with ease right away
- Also a separate Database Management feature assists users to add new data into the database seamlessly



#### 6) Computer System Requirements

- Processor: Intel® Pentium® III processor (500 Mhz) or higher
- Operating system: Windows® 98, ME, 2000, NT4 or Windows XP
- 128 MB of available RAM (256 or higher recommended)
- 500 MB of available hard disk space or more
- CD-ROM drive
- Video card capable of displaying a minimum of 256 colors at 1024 x 768 resolution.