Determining the Coefficient of Friction Between Industrial Furnace Components

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Submitted in partial fulfilment of the requirements for the degree of
BACHELOR OF APPLIED SCIENCE
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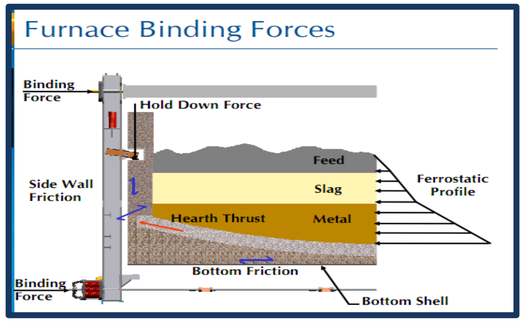
Client

A leading professional services firm which provides engineering and development consultancy services to the metallurgical industry. Their Furnace Technology and Services group specializes in the design of industrial furnaces.

Background

Industrial arc furnaces incorporate thermal insulating components and large binding forces to contain high pressures produced during the smelting process. The binding forces cause substantial friction between furnace components. Accurate coefficient of friction data is required in order to reduce operational and maintenance costs and decrease revenue losses due to down time.



Aim & Goal

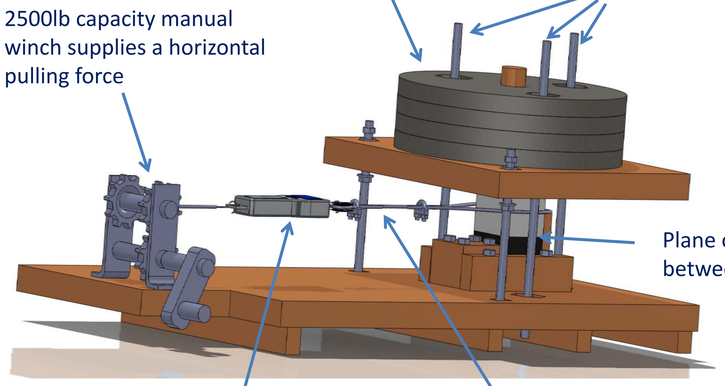
Design and build an experimental setup to provide a comprehensive matrix of empirically derived static coefficient of friction data between a variety of furnace components while simulating operational contact pressures.

Apparatus Design

35lb weight increments applying a normal force to simulate pressures between 50-250kPa

0.5” Steel guide rods to prevent excessive sliding and tipping

2500lb capacity manual winch supplies a horizontal pulling force



Plane of contact between samples

500lb capacity force gauge to record applied horizontal force

3/16” high tension steel wire

$$\mu = \frac{F_f}{F_N}$$

Expected Deliverable

The combination of materials that come into contact within the furnace’s design are identified and ranked in the above matrix. Future work consists of obtaining coefficient of friction data for each combination through extensive testing utilising the custom built testing apparatus.

Material	Steel	Copper	Slip Plate Paint	Fire Clay Brick	Mg-Cr Brick	Al-Cr Brick	Mg Brick	Al Brick
Steel	1							
Copper	3	2						
Slip Plate Paint	1	2	2					
Fire Clay Brick	1	3	1	1				
Mg-Cr Brick	2	3	2	3	1			
Al-Cr Brick	2	3	2	3	3	1		
Mg Brick	2	3	2	3	3	3	1	
Al Brick	2	3	2	3	3	3	3	1

1 Top Priority (Must Have)
2 Secondary Importance (Nice to Have)
3 Academic (Possible Future Project)

Applied skills

Valuable experience was gained through the application of theoretical knowledge to practical problems of interest to industry. These include:

- Industrial Furnace Design and Operation
- Project Management
- Client Relations
- Design Optimization
- Product Design and Construction

This Furnace Technology and Services Project represents an excellent opportunity to utilise mechanical engineering disciplinary knowledge and skills. These include:

- Statics and Dynamics
- Material Science
- Solid Mechanics
- Statistics

Experience Gained

2011/2012