Refractory Considerations for Melting Ductile Iron

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Allied Mineral Products

Melting Equipment

- Primary Melting - Coreless

Silica Lining Wear

- Reduced lining life due to
  - Deeper lining saturation
  - Buildup
  - More pronounced elephant's foot wear
  - Floor spalling
  - Top cap separation

Lining Saturation

- Deep saturation can occur behind lining hot face

Low Porosity Silica Refractory

- Silica refractories with higher density/lower porosity can reduce saturated layer
- Bond level (boron oxide or boric acid) must be matched to application temperatures
- Alloy additions should be made at midlevel or higher in furnace when charging furnace

Buildup

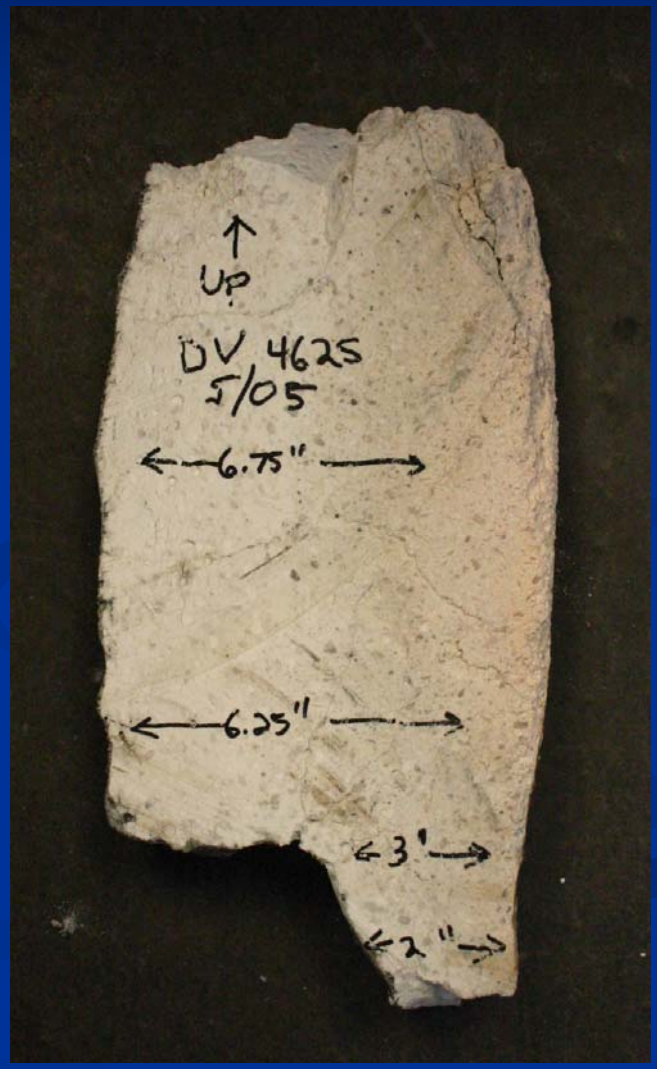
- Buildup can be a result of charging a high percentage of ductile iron remelt or from some ferroalloy additions.
- A supplemental flux, such as Redux, can be used to control buildup.
- When removing buildup, avoid mechanical damage to the sidewall.

Elephant's Foot Wear

- Elephant's foot wear occurs most often in main frequency (heel melting) furnaces
- The wear is more acute when running ductile iron, especially when the average tap temperature is high

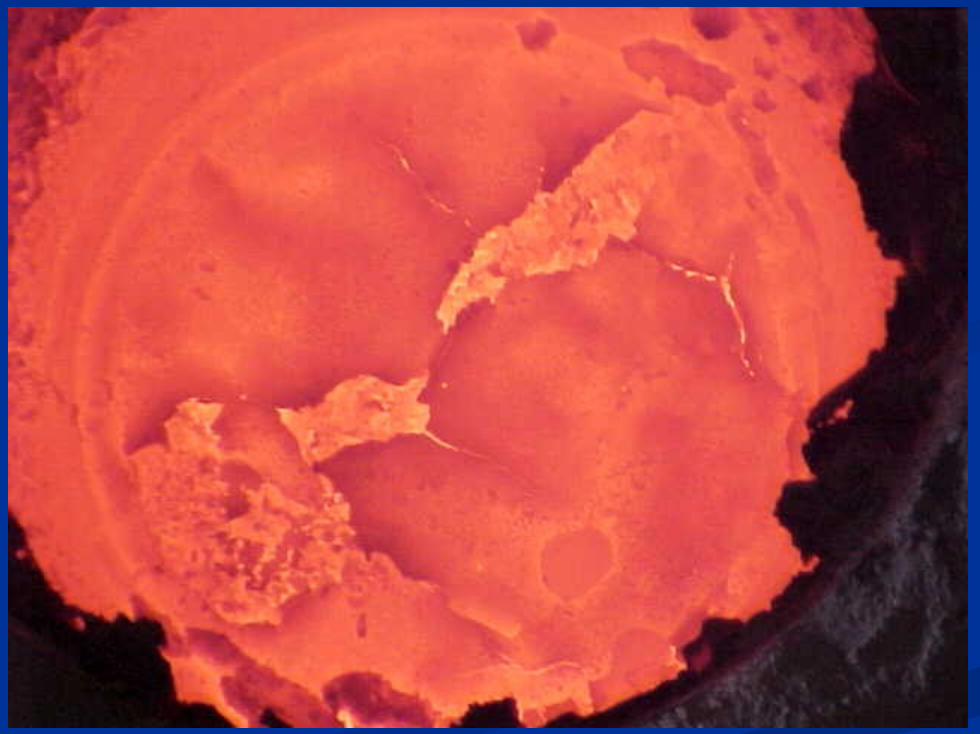
Elephant's Foot Wear

- Lining wear occurs in specific areas of the furnace.
- Optimization of installation, sintering, temperature control, and charging are important process variables.
- Taper shave can be a repair option.



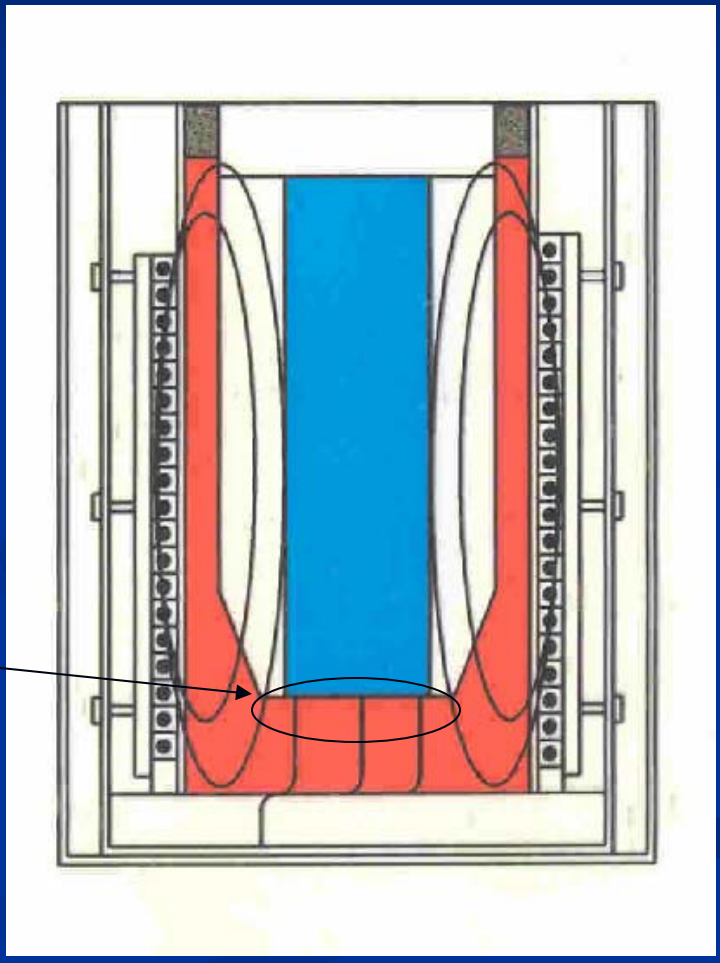
Floor Spalling

- Spalling is due to insufficient sinter temperature in the floor in high powered, medium frequency furnaces
- Poor sintering results in increased saturation and differential expansion spalling



Floor Wear

- Fused silica or zircon addition can reduce thermal expansion on the floor area.



Silica vs. Fused Silica

Top Cap Separation

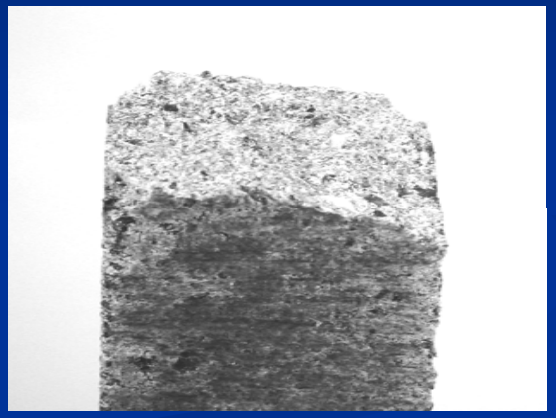
- Top cap separation is due to material expansion differences, and sharp thermal gradients/
- Materials used
  - Alumina-Silicate Dry Vibratables
  - Fused Silica Dry Vibratables

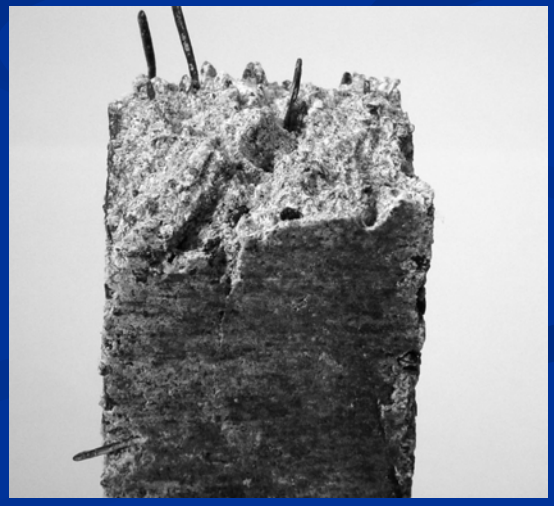
Castable Top Cap Repair

Castable Top Cap – Large Furnace

Fiber-Reinforced Refractory

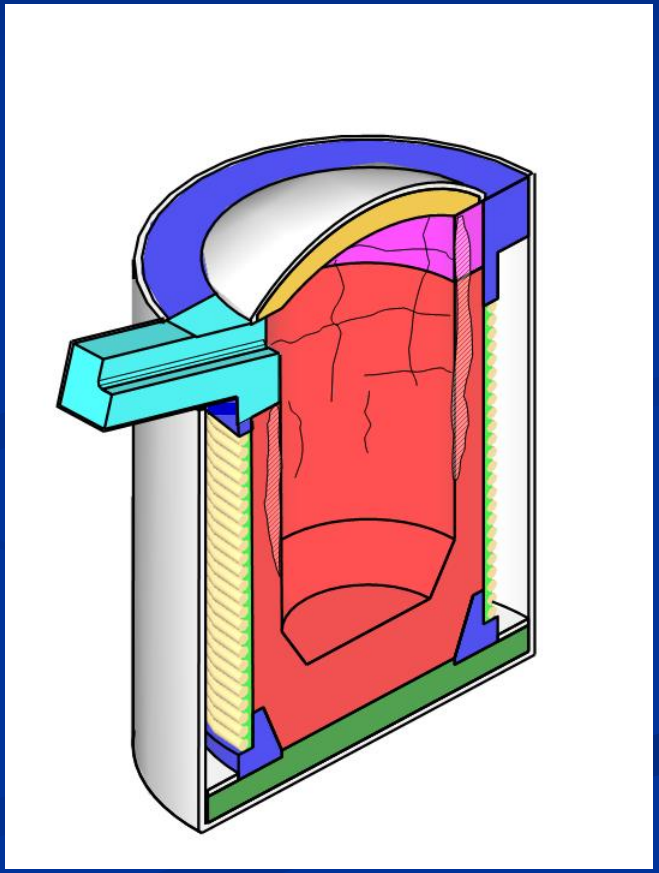
- Crack propagation is inhibited by the use of metallic fiber as a toughening mechanism.
- Used for many years in castables, but how about in linings of coreless furnaces?





Metallic Fibers – Now in the Lining?

- Reduction in thermal cracking in top cap and working lining
- Increased toughness can decrease mechanical wear



Coreless Melting Process Variables

- Charge material
- Operating pattern
- Process temperature control
- Installation and sintering of silica lining