

# Ironmaking Mathematical Modelling

## Blast Furnace

### Hearth Thickness Monitoring



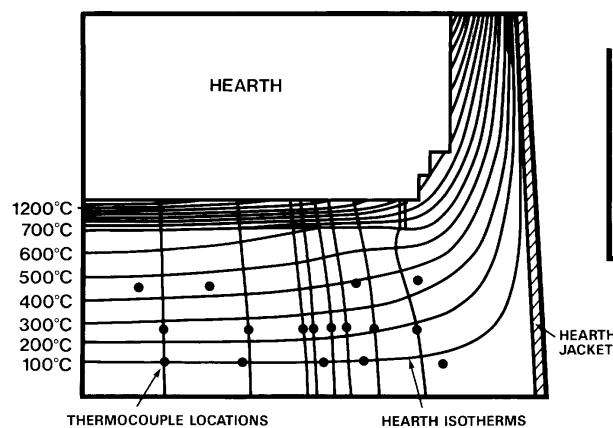
**This is an essential primary tool to reduce furnace breakouts and increase furnace campaigns and is installed on all Corus furnaces.**

The hearth of a blast furnace has the task of containing the molten iron for many years during modern blast furnace campaigns. It is vital for the operators to know the state of the hearth at all times. Corus has developed a computer-based method of estimation of hearth refractory thickness.

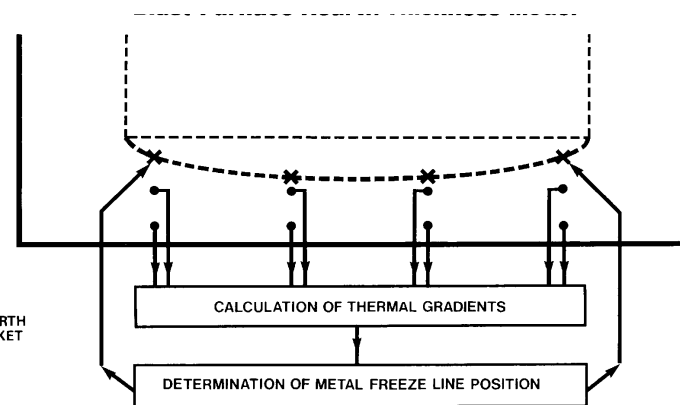
During construction of the hearth, thermocouples are inserted in arrays at several different levels. During operation of the furnace, the arrays of thermocouples enable the thermal gradients at a series of points across the hearth to be calculated, and this allows estimation of the position of the 1150°C isotherm. This is the temperature at which carbon-saturated iron freezes, and this isotherm is taken as the boundary between the iron and the hearth, allowing the thickness of the hearth to be estimated.

A similar method can be utilised to estimate hearth sidewall thickness.

The figures below show in schematic form the principle of operation of the model and an example of the output in the case for a new carbon hearth with the ceramic pad partially intact.



**EXAMPLE OF HEARTH CARBON ISOTHERMS WITH THIN CERAMIC PAD REMAINING**



**BLAST FURNACE HEARTH THICKNESS MODEL**

The main benefits of using this model are:

- It is an essential tool for any blast furnace manager
- Ensures corrective actions can be taken as a result of comprehensive monitoring of temperature excursions
- Extends the blast furnace life and therefore campaign life
- Has provided ZERO hearth breakouts since installation on Corus plants
- Can be fitted retrospectively