

# Heat Transfer Analysis Blast Furnace Design



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Corus, through its Teesside Technology Centre has considerable experience in the application of heat transfer studies to the design of blast furnaces. Two areas of importance are hearth linings and cooling staves.

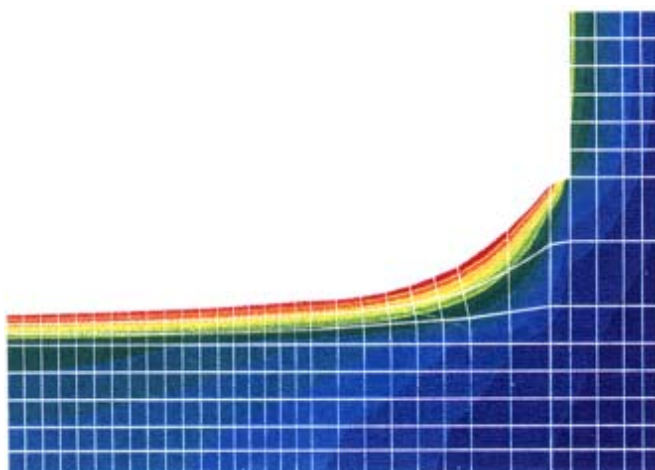
Hearth linings and their cooling systems have become critical areas since operators now aim for long campaigns and the furnace life is generally limited by the loss of hearth lining integrity.

Finite Element (FE) modelling of hearth temperature profiles is used to assess the likely degree of lining wear. The models incorporate data on the performance of the cooling systems, heat loss through the foundations, lining thermal properties and heat transfer from the sump materials.

The models can be used to select the appropriate type of lining material. They can reduce reline costs by avoiding the installation of needlessly thick linings.

Results from the models are also used during furnace operation as the basis of methods for evaluating lining wear.

Many blast furnaces now have their walls partly or wholly cooled by staves, either the standard cast iron or the more recent copper bodied designs.

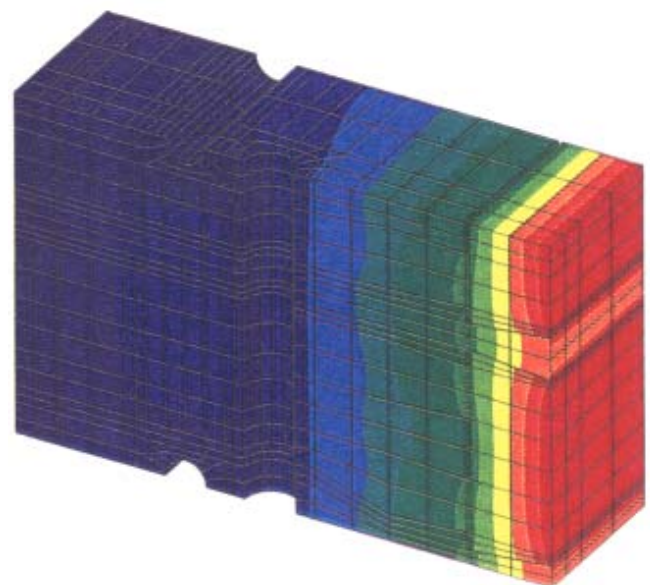


**PREDICTED TEMPERATURE PROFILE THROUGH HALF SECTION OF A PROPOSED HEARTH**

Staff design involves matching the cooling capacity to the heat load at the appropriate location in the furnace. This is achieved by a suitable density and disposition of the internal cooling pipes. The effect of different pipe arrangements is evaluated by FE models.

The results show whether a particular design can absorb the relevant heat load while keeping the iron casting below the phase change temperature.

To ensure the validity of the results, the staff FE models use data obtained from tests conducted in the laboratory, and from measurements on working staves.



**CALCULATED TEMPERATURE PROFILE IN A SECTION OF A TYPICAL MODERN STAFF**

The main benefits from using Heat Transfer Analysis for blast furnace design are:-

- Prolonged hearth and furnace refractory life.
- Extended furnace campaigns.
- Improved process information (from thermocouple locations) suitable for use with other models used by Corus.
- Can be used as a diagnostic tool monitoring the wear rates in the refractories.