

# Ironmaking Mathematical Modelling

## Blast Furnace

### Heat and Mass Balance



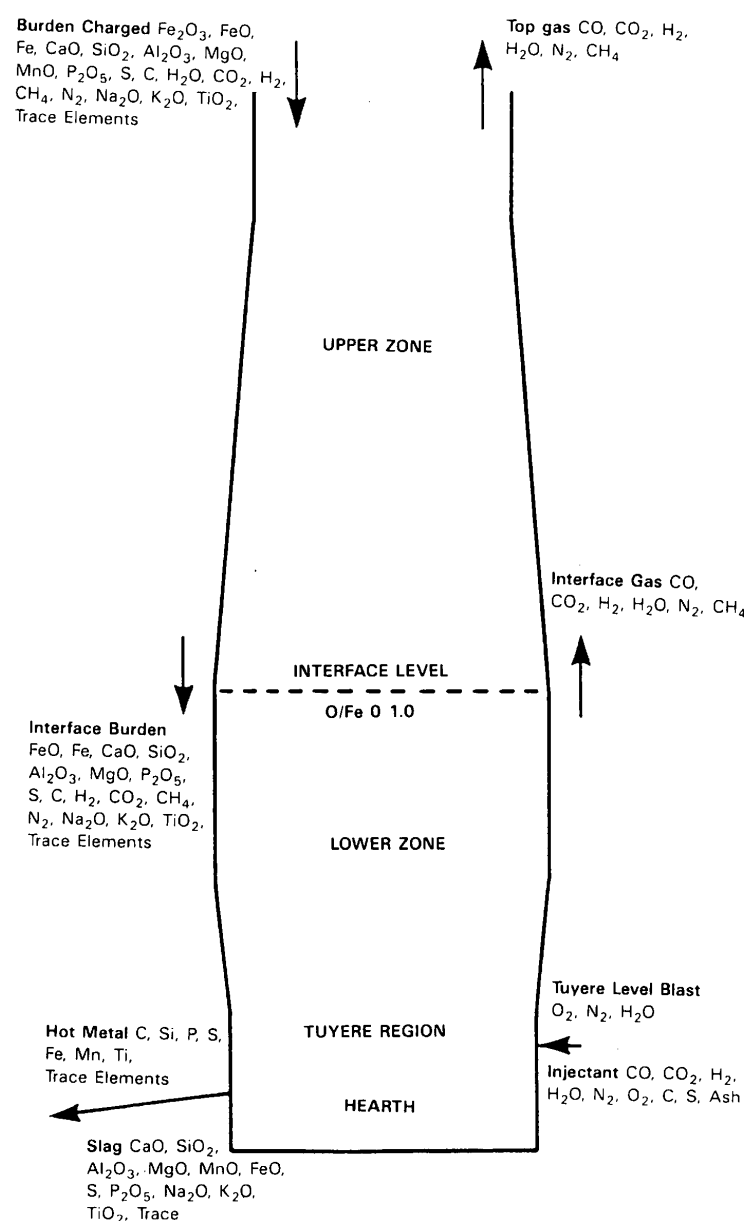
As modern blast furnaces have increased rapidly in size, it has become increasingly important that the most efficient operating conditions should be identified for each plant. The use of a heat and mass balance model allows accurate assessment of blast furnace operation, identifying areas of imbalance and allowing corrective action to proceed. Once an assessment has been achieved, the prediction routine can be used to help optimise and increase overall furnace efficiency.

The model consists of a series of simultaneous non-linear equations which represent the processes occurring within all blast furnaces, and thus potentially represents any blast furnace. Its concept is based on dividing the blast furnace into two thermo-chemical regions (the Upper and Lower Zone), and carrying out mass balances of all solids, liquids and gases either charged to or produced within the blast furnace. A comprehensive heat balance over both zones is also undertaken.

The model can be used in either assessment or prediction mode, (ie On-line or Off-line)

The **benefits** of assessing a furnace practice On-line are:

- Helps maximise operating efficiency
- Evaluates the important process variables
- As a cross-check tool to evaluate the accuracy of the process data gathered by measurement
- Assists in detection of shifts in the burden distribution patterns
- Establish any materials imbalances
- Calculate parameters which are difficult to measure with a greater degree of accuracy
- Helps maintain product quality and consistency
- Promotes improved furnace operating stability



The **benefit** to be gained operating the model off-line is its ability to predict the effects to blast furnace performance brought about by changes to operating parameters (such as blast volume or temperature, injectant rates, burdening changes etc.). These can be evaluated without putting the furnace at risk.