

# Ironmaking Mathematical Modelling

## Blast Furnace

### Burden Calculation



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Most blast furnace operators have a simple model which calculates slag analysis and slag volume from details of the burden charge weights and chemical analysis. The Ironmaking Department has developed a more sophisticated model which enables burden composition or sinter analysis to be evaluated for any required slag chemistry or volume.

Many furnaces have to make frequent changes in burden composition to respond to changes in materials stocks, sinter analysis, etc. Fluxes have to be calculated and this is often by manual iteration of a simple burden calculation. The Ironmaking Department have developed a model which allows these and other calculations to be carried out quickly and in one operation.

The model operates from a data base containing the chemical analyses of all available burden materials and coke sources. For automatic operation, at every burden change, the data base is automatically updated with the most recent sinter and coke analyses.

The model contains a series of mass balance equations for the main slag constituents, i.e. SiO<sub>2</sub>, CaO, Al<sub>2</sub>O<sub>3</sub>, MgO, etc. and, by simultaneous solution of these equations in one of several preset modes, can produce:

- The slag analysis and slag volume for a known burden composition.
- The necessary proportions of available materials to produce a required slag chemistry and slag volume.
- The necessary sinter analysis to accompany other known burden components to produce a required slag analysis and slag volume.

The model can accommodate various tuyere injectants, e.g. coal, oil.

The main benefits of using this model are:-

- Attainment of hot metal and slag specifications
- Provides a useable tool for a materials balance through the process
- Can be used as an On-line or Off-line tool

An example is given of the output from one model installation where the burden composition was required for a particular slag analysis.

### BURDEN CALCULATION RESULTS

METAL ANALYSIS (%)			
Si	S	Mn	P
0.50	0.030	0.66	0.128

PRODUCT t/CHARGE	
HM	SLAG
59.60	17.13

#### MATERIAL LOAD (TONNE/ch)

1. SINTER	73.73
2. FIRELAKE P	20.86
3. LIMESTONE	0.25
4. OLIVINE	0.72
5. BAUXITE	0.60

SLAG ANALYSIS (%)					
SiO <sub>2</sub>	CaO	MgO	Al <sub>2</sub> O <sub>3</sub>	C/S	C+M/S+A
35.0	39.0	8.0	13.5	1.11	0.97

UNIT (Kg/T-P)			INPUTS (Kg/T-P)		
CR	PCIR	SV	TiO <sub>2</sub>	Mn	S
500	0.00	310	3.86	8.71	4.24

ORE TOTAL	94.59
BURDEN TOTAL	96.16