Coal Ash Absorbed by Clinker

Coal ash absorbed by clinker, from the analyses of raw mix, clinker and coal ash (four oxide balances), and the share of the fired ash that ends up in clinker.

Method: Duda; Cement Data Book; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
SiO_2 in the raw mix (ignited)	19.000	%
Al_2O_3 in the raw mix (ignited)	8.2500	%
Fe_2O_3 in the raw mix (ignited)	2.8000	%
CaO in the raw mix (ignited)	66.600	%
SiO_2 in the clinker	19.850	%
Al_2O_3 in the clinker	8.9200	%
Fe_2O_3 in the clinker	3.3100	%
CaO in the clinker	64.450	%
SiO_2 in the coal ash	42.950	%
Al_2O_3 in the coal ash	27.880	%
Fe_2O_3 in the coal ash	17.600	%
CaO in the coal ash	4.9500	%
Specific heat consumption	3,600.0	kJ/kg
Net calorific value of the coal	25.000	MJ/kg
Ash in the coal	25.000	%

Calculated results

Parameter	Value	Unit
Absorption from the CaO balance	3.4874	%
Absorption from the SiO_2 balance	3.5491	%
Absorption from the Al_2O_3 balance	3.4131	%
Absorption from the Fe_2O_3 balance	3.4459	%
Coal ash absorbed (mean, % of clinker)	3.4739	%
Coal ash fired per kg clinker	36.000	kg/t
Share of the fired ash absorbed	96.497	%

Notes for this case

- The four balances should agree; a large spread means unrepresentative samples or dust and volatile losses. Long and preheater kilns absorb nearly all ash; short kilns with high dust loss 30–100 % (Duda).

Formula and method

$$q_X = \frac{X_k - X_m}{X_a - X_m}, \quad q = \frac{q_C + q_S + q_A + q_F}{4}, \quad a_{in} = \frac{q_{heat}}{NCV} a_c$$

Variables

S_m	SiO_2 in the raw mix (ignited)	-

A_m	Al_2O_3 in the raw mix (ignited)	-
F_m	Fe_2O_3 in the raw mix (ignited)	-
C_m	CaO in the raw mix (ignited)	-
S_k	SiO_2 in the clinker	-
A_k	Al_2O_3 in the clinker	-
F_k	Fe_2O_3 in the clinker	-
C_k	CaO in the clinker	-
S_a	SiO_2 in the coal ash	-
A_a	Al_2O_3 in the coal ash	-
F_a	Fe_2O_3 in the coal ash	-
C_a	CaO in the coal ash	-
q	Specific heat consumption	J/kg
NCV	Net calorific value of the coal	J/kg
a_c	Ash in the coal	-
q_C	Absorption from the CaO balance	-
q_S	Absorption from the SiO_2 balance	-
q_A	Absorption from the Al_2O_3 balance	-
q_F	Absorption from the Fe_2O_3 balance	-
a_{in}	Coal ash fired per kg clinker	kg/kg
q/a_{in}	Share of the fired ash absorbed	-

Method and standards

Oxide balances of raw mix, ash and clinker.

Assumptions and limits

- All four oxides conserved.

References

- Duda
- Cement Data Book
- Vol. 1
- 3rd ed. (Bauverlag / Macdonald and Evans, 1985)
- sec. 2.6 and Example 2.6

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/chemical/cement/coal-ash-absorption-clinker

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.