Clinker Liquid Phase Content at Burning Temperature

Share of liquid (melt) in cement clinker at 1400 °C or 1450 °C from its alumina, iron oxide, magnesia and alkalis, which governs burnability and coating.

Method: Lea and Parker liquid-phase formulas

Input parameters

Unit system: SI

Parameter	Value	Unit
Al_2O_3 in clinker	5.5000	%
Fe_2O_3 in clinker	3.5000	%
MgO in clinker (up to about 2 % counts)	1.5000	%
K_2O in clinker	0.80000	%
Na_2O in clinker	0.20000	%
Temperature	1450 °C	

Calculated results

Parameter	Value	Unit
Liquid phase content	26.875	%
Alumina modulus A/F	1.5714	

Notes for this case

• At burning temperature the aluminate and ferrite phases melt together with part of the magnesia and alkalis. Lea and Parker's formulas give the liquid share: L = 3.0 A + 2.25 F + M + K + N at 1450 °C and 2.95 A + 2.2 F + M + K + N at 1400 °C (oxide per cents, MgO counted up to about 2 %). About 23–27 % liquid at 1450 °C burns well and forms a stable coating; less makes hard burning and dusty clinker, more gives rings and balls. The formulas apply for alumina moduli above about 0.64.

Formula and method

$$L_{1450} = 3.0A + 2.25F + M + K + N, \quad L_{1400} = 2.95A + 2.2F + M + K + N$$

Variables

A	Al_2O_3 in clinker	-
F	Fe_2O_3 in clinker	-
M	MgO in clinker (up to about 2 % counts)	-
K	K_2O in clinker	-
N	Na_2O in clinker	-
T	Temperature	-
L	Liquid phase content	-
AM	Alumina modulus A/F	-

Method and standards

Liquid phase.

Assumptions and limits

- Equilibrium melting; alumina modulus above about 0.64.

References

Lea and Parker liquid-phase formulas

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/clinker-liquid-phase-content

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.