Ladle Desulphurisation: Sulphur Partition and Final Sulphur

Equilibrium sulphur partition from the slag constant K_SA and dissolved aluminium, and the final steel sulphur from a sulphur balance with the slag mass.

Input parameters

Unit system: SI

Parameter	Value	Unit
log K_SA (from the slag chart)	3.6000	
Dissolved aluminium	0.030000	%
Steel mass	150.00	t
Slag mass	1.5000	t
Initial sulphur in steel	0.010000	%
Initial sulphur in slag	0.050000	%

Calculated results

Parameter	Value	Unit
Sulphur partition (%S)/[%S]	384.37	
Final sulphur in steel	21.678	ppm
Final sulphur in slag	0.83322	%
Desulphurisation	78.322	%

Notes for this case

• Read log K_SA from the slag chart for the CaO/Al_2O_3 ratio, SiO_2 and temperature (about 3.2-4.6 for lime-saturated calcium aluminate slags). Equilibrium is the limit; the stirring time sets how close the ladle gets. Silicon-killed steels cannot be desulphurised this far because their oxygen potential is higher.

Formula and method

$$L_S = \frac{(\%S)}{[\%S]} = K_{SA}[\%Al]^{2/3}, \quad [\%S] = \frac{W[\%S]_0 + W_s(\%S)_0}{W + L_S W_s}$$

Variables

$\log K_{SA}$	log K_SA (from the slag chart)	-
$[\%Al]$	Dissolved aluminium	-
W	Steel mass	kg
W_s	Slag mass	kg
$[\%S]_0$	Initial sulphur in steel	-
$(\%S)_0$	Initial sulphur in slag	-
L_S	Sulphur partition (%S)/[%S]	-
$[\%S]$	Final sulphur in steel	-
$(\%S)$	Final sulphur in slag	-
η_S	Desulphurisation	-

Method and standards

Slag-metal sulphur equilibrium with a sulphur mass balance.

Assumptions and limits

- Equilibrium; CaS saturation not checked.

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

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

This calculator online

https://calc.firecad.com/materials/steelmaking-foundry/ladle-desulphurisation-partition

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.