Carbon-Oxygen Equilibrium in Liquid Steel and Oxygen Saturation

Dissolved oxygen in equilibrium with carbon at a CO pressure, [%C][ppm O] = 20 pCO, the effect of vacuum and the oxygen solubility limit with liquid iron oxide.

Input parameters

Unit system: SI

Parameter	Value	Unit
Carbon content	0.050000	%
CO partial pressure	1.0000	atm
CO pressure under vacuum	0.20000	atm
Melt temperature	1,600.0	°C

Calculated results

Parameter	Value	Unit
Equilibrium oxygen at p_CO	400.00	ppm
Equilibrium oxygen at the vacuum CO pressure	80.000	ppm
Oxygen solubility with liquid FeO	0.22855	%
Carbon below which iron oxide forms (at p_CO)	0.008751	%

Notes for this case

- K = 20 is not very sensitive to temperature and holds for low-alloy steel below about 1 % C. Lowering the CO pressure by vacuum lowers the oxygen in equilibrium with a given carbon, which is how RH and VD units decarburise without oxygen.

Formula and method

$$[\%C][\text{ppm O}] = 20\,p_{CO}, \quad \log[\%O]_{sat} = -\frac{6380}{T} + 2.765$$

Variables

$[\%C]$	Carbon content	-
p_{CO}	CO partial pressure	Pa
$p_{CO}{}'$	CO pressure under vacuum	Pa
T	Melt temperature	K
$[O]$	Equilibrium oxygen at p_CO	-
$[O]'$	Equilibrium oxygen at the vacuum CO pressure	-
$[\%O]_{sat}$	Oxygen solubility with liquid FeO	-
$[\%C]_{min}$	Carbon below which iron oxide forms (at p_CO)	-

Method and standards

Carbon-oxygen equilibrium in liquid iron.

Assumptions and limits

- Low-alloy steel below 1 % C; equilibrium, not kinetics.

Report details

Report reference	FCC-AT81-1A8W (the same inputs always give the same reference)
Generated	23 November 2026, 17:51 UTC
Calculator	Carbon-Oxygen Equilibrium in Liquid Steel and Oxygen Saturation
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
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/steel-carbon-oxygen-equilibrium

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.