Alloy Density from Composition (Rule of Mixtures)

Approximate density of an alloy or mixture from the mass fractions and densities of up to four constituents, by volume additivity.

Method: Ideal volume additivity 1/ρ = Σ w_i/ρ_i

Input parameters

Unit system: SI

Parameter	Value	Unit
Constituent 1: mass fraction	70.000	%
Constituent 1: density	7,874.0	kg/m³
Constituent 2: mass fraction	19.000	%
Constituent 2: density	7,190.0	kg/m³
Constituent 3: mass fraction	9.0000	%
Constituent 3: density	8,908.0	kg/m³
Constituent 4: mass fraction	2.0000	%
Constituent 4: density	7,210.0	kg/m³

Calculated results

Parameter	Value	Unit
Alloy density	7,800.1	kg/m³
Specific volume	0.12820	L/kg

Notes for this case

- Volume additivity is an approximation; measured alloy densities can differ by a per cent or so.

Formula and method

$$\frac{1}{\rho} = \sum_i \frac{w_i}{\rho_i}$$

Variables

w_1	Constituent 1: mass fraction	-
ρ_1	Constituent 1: density	kg/m³
w_2	Constituent 2: mass fraction	-
ρ_2	Constituent 2: density	kg/m³
w_3	Constituent 3: mass fraction	-
ρ_3	Constituent 3: density	kg/m³
w_4	Constituent 4: mass fraction	-
ρ_4	Constituent 4: density	kg/m³
ρ	Alloy density	kg/m³
v	Specific volume	m³/kg

Method and standards

Volume additivity.

Assumptions and limits

- Ideal mixing.
- Mass fractions that do not add to 100 % are normalised, with a note.

References

- Ideal volume additivity $1/\rho = \Sigma\, w_i/\rho_i$

Report details

Report reference	FCC-JR87-EDT9 (the same inputs always give the same reference)
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Calculator	Alloy Density from Composition (Rule of Mixtures)
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Release checks	2 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/properties/alloy-density-mixture

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.