Gas Mixture Viscosity by Wilke's Rule (Binary)

Viscosity of a binary gas mixture from the pure-gas viscosities, molar masses and mole fractions by Wilke's semi-empirical mixing rule (Perry's sec. 2).

Method: Perry's Chemical Engineers' Handbook; 9th ed. (McGraw-Hill, 2019); ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Mole fraction of gas 1	50.000	%
Viscosity of gas 1	0.017600	cP
Viscosity of gas 2	0.014700	cP
Molar mass of gas 1	28.014	kg/kmol
Molar mass of gas 2	44.009	kg/kmol

Calculated results

Parameter	Value	Unit
Interaction parameter Φ_{12}	1.3682	
Interaction parameter Φ_{21}	0.72743	
Mixture viscosity	0.015942	cP

Formula and method

$$\mu_m = \sum_i \frac{y_i \mu_i}{\sum_j y_j \Phi_{ij}}, \quad \Phi_{ij} = \frac{\left[1 + (\mu_i/\mu_j)^{1/2} (M_j/M_i)^{1/4}\right]^2}{\sqrt{8(1 + M_i/M_j)}}$$

Variables

y_1	Mole fraction of gas 1	-
μ_1	Viscosity of gas 1	Pa·s
μ_2	Viscosity of gas 2	Pa·s
M_1	Molar mass of gas 1	kg/kmol
M_2	Molar mass of gas 2	kg/kmol
Φ_{12}	Interaction parameter Φ_{12}	-
Φ_{21}	Interaction parameter Φ_{21}	-
μ_m	Mixture viscosity	Pa·s

Method and standards

Wilke's rule (Φ_ii = 1).

Assumptions and limits

- Low-pressure gases.

References

• Perry's Chemical Engineers' Handbook
• 9th ed. (McGraw-Hill, 2019)
• sec. 2 (transport properties): Wilke's mixing rule for low-pressure gas mixtures

Report details

Report reference	FCC-HABM-T1FH (the same inputs always give the same reference)
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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/chemical/unit-operations/gas-mixture-viscosity-wilke

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.