Strain-Rate Sensitivity Exponent m

Strain-rate sensitivity exponent m and constant C of the flow stress from tests at two strain rates, and the flow stress at another rate (superplasticity check).

Method: Strain-rate sensitivity

Input parameters

Unit system: SI

Parameter	Value	Unit
Flow stress at rate 1	32.000	MPa
Strain rate 1 (1/s)	0.001000	
Flow stress at rate 2	48.000	MPa
Strain rate 2 (1/s)	0.010000	
Strain rate to evaluate (1/s)	0.10000	

Calculated results

Parameter	Value	Unit
Strain-rate sensitivity	0.17609	
Constant (stress at unit rate)	108.00	MPa
Flow stress at the rate	72.000	MPa
Superplastic range (1 = yes)	0	

Notes for this case

• σ = Cε̇^m at fixed strain and temperature, so two tests give m = ln(σ₂/σ₁)/ln(ε̇₂/ε̇₁). At room temperature metals have m below about 0.02; in hot working 0.1–0.2; superplastic alloys (fine grains, about half the melting point) reach 0.3–0.8, which resists necking and allows elongations of hundreds of percent. Rate-change tests on one specimen avoid scatter between specimens.

Formula and method

$$m = \frac{\ln(\sigma_2/\sigma_1)}{\ln(\dot{\varepsilon}_2/\dot{\varepsilon}_1)}, \quad \sigma = C\dot{\varepsilon}^m$$

Variables

σ_1	Flow stress at rate 1	Pa
$\dot{\varepsilon}_1$	Strain rate 1 (1/s)	-
σ_2	Flow stress at rate 2	Pa
$\dot{\varepsilon}_2$	Strain rate 2 (1/s)	-
$\dot{\varepsilon}$	Strain rate to evaluate (1/s)	-
m	Strain-rate sensitivity	-
C	Constant (stress at unit rate)	Pa
σ	Flow stress at the rate	Pa
$m \geq 0.3$	Superplastic range (1 = yes)	-

Method and standards

Rate sensitivity.

Assumptions and limits

- Same strain and temperature for both tests; power-law behaviour.

References

Strain-rate sensitivity

Report details

Report reference	FCC-VXS4-GQGZ (the same inputs always give the same reference)
Generated	23 November 2026, 17:50 UTC
Calculator	Strain-Rate Sensitivity Exponent m
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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/properties/strain-rate-sensitivity

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.