Tafel Slope and Exchange Current from Two Cell Points

Tafel constant, slope per decade, charge transfer coefficient and exchange current density from two activation-region voltage and current density points.

Method: Tafel equation fitted to two points

Input parameters

Unit system: SI

Parameter	Value	Unit
First current density	1.0000	mA/cm²
Cell voltage at i_1	0.90000	V
Second current density	10.000	mA/cm²
Cell voltage at i_2	0.82000	V
Reversible voltage	1.1800	V
Cell temperature	80.000	°C

Calculated results

Parameter	Value	Unit
Tafel constant (V per natural log unit)	34.744	mV
Tafel slope per decade	80.000	mV
Charge transfer coefficient RT/(2AF)	0.43795	
Exchange current density	3.1623e-04	mA/cm²

Notes for this case

• Tafel: V = E − A ln(i/i_0). Two points in the activation-dominated region give A; extrapolating to V = E gives i_0. Ohmic losses between the points inflate A, so use low current densities or iR-corrected voltages.

Formula and method

$$A = \frac{V_1 - V_2}{\ln(i_2/i_1)}, \quad i_0 = i_1 \exp\left(-\frac{E - V_1}{A}\right), \quad \alpha = \frac{RT}{2AF}$$

Variables

i_1	First current density	A/m²
V_1	Cell voltage at i_1	V
i_2	Second current density	A/m²
V_2	Cell voltage at i_2	V
E	Reversible voltage	V
T	Cell temperature	K
A	Tafel constant (V per natural log unit)	V
b	Tafel slope per decade	V
α	Charge transfer coefficient RT/(2AF)	-
i_0	Exchange current density	A/m²

Method and standards

Tafel fit.

Assumptions and limits

- Activation-controlled region; one electrode dominant.

References

Tafel equation fitted to two points

Report details

Report reference	FCC-AT2Y-RWVE (the same inputs always give the same reference)
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Calculator	Tafel Slope and Exchange Current from Two Cell Points
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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/environmental/hydrogen-fuel-cells/tafel-slope-from-two-points

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.