Electroplating Thickness and Time (Faraday)

Plated thickness from current, time, area and current efficiency by Faraday's law, and the time for a target thickness, for any metal entered by its data.

Method: Faraday's law m = I t η M/(n F); thickness = m/(ρA)

Input parameters

Unit system: SI

Parameter	Value	Unit
Plating current	50.000	A
Plating time	30.000	min
Area being plated	1.5000	m²
Cathode current efficiency	90.000	%
Molar mass of the deposited metal	58.693	kg/kmol
Electrons per ion	2.0000	
Deposit density	8,908.0	kg/m³
Target thickness	10.000	µm

Calculated results

Parameter	Value	Unit
Mass deposited	24.637	g
Thickness	1.8438	µm
Current density	0.33333	A/dm²
Time for the target thickness	162.71	min

Notes for this case

- Average thickness; edges plate thicker and recesses thinner.

Formula and method

$$m = \frac{I t \eta M}{n F}, \quad \delta = \frac{m}{\rho A}$$

Variables

I	Plating current	A
t	Plating time	s
A	Area being plated	m²
η	Cathode current efficiency	-
M	Molar mass of the deposited metal	kg/kmol
n	Electrons per ion	-
ρ	Deposit density	kg/m³
δ_t	Target thickness	m
m	Mass deposited	kg
δ	Thickness	m
i	Current density	A/m²
t_t	Time for the target thickness	s

Method and standards

Faraday's law.

Assumptions and limits

- Uniform deposit.
- The metal is defined by its molar mass, electrons per ion and deposit density, entered by you; the defaults are nickel.
- With zero current the time to the target is not shown.

References

- Faraday's law m = I t η M/(n F); thickness = m/(ρA)

Report details

Report reference	FCC-MNQ1-36HJ (the same inputs always give the same reference)
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Calculator	Electroplating Thickness and Time (Faraday)
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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/corrosion/electroplating-thickness-time

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.