

Powder Metallurgy Cheat Sheet

Steps, compaction pressures, sintering and variants

ENGINEERING
CHEAT SHEET

Key equations

Quantity	Equation	Notes
Process	Powder → blend → compact → sinter → finish	Green compact is fragile until sintered
Compaction pressure, Al powder	about 10 ksi (70 MPa)	Article's figure
Compaction pressure, iron powder	about 120 ksi (800 MPa)	Article's figure
Sintering temperature range	760-2400 °C (1400-4352 °F)	Below the melting point; atmosphere, temperature, time
Sintered density	Parts are only about 75% solid	Interconnected pores, so strength follows density
Isostatic pressing	5-10% higher density	Omnidirectional pressure

Key takeaways

- Atomization is the main powder route: gas, water, centrifugal or rotating-electrode.
- Ceramic powders are crushed (roll, ball or hammer milling); irregular shape bonds better.
- Density is highest at the edges and lowest at the center after die compaction.
- Advantages: high-melting materials, controlled porosity (bearings), bimetallic parts, good finish, little machining.
- Limits: uneven thickness, sharp corners, threads, cross holes; press size caps the part; tooling and powder are costly.
- Variants: CIP, HIP (near-zero porosity), powder rolling, extrusion, forging, injection molding, additive manufacturing.
- Sinter at least 60 minutes to see the full temperature effect (shown for 316L).