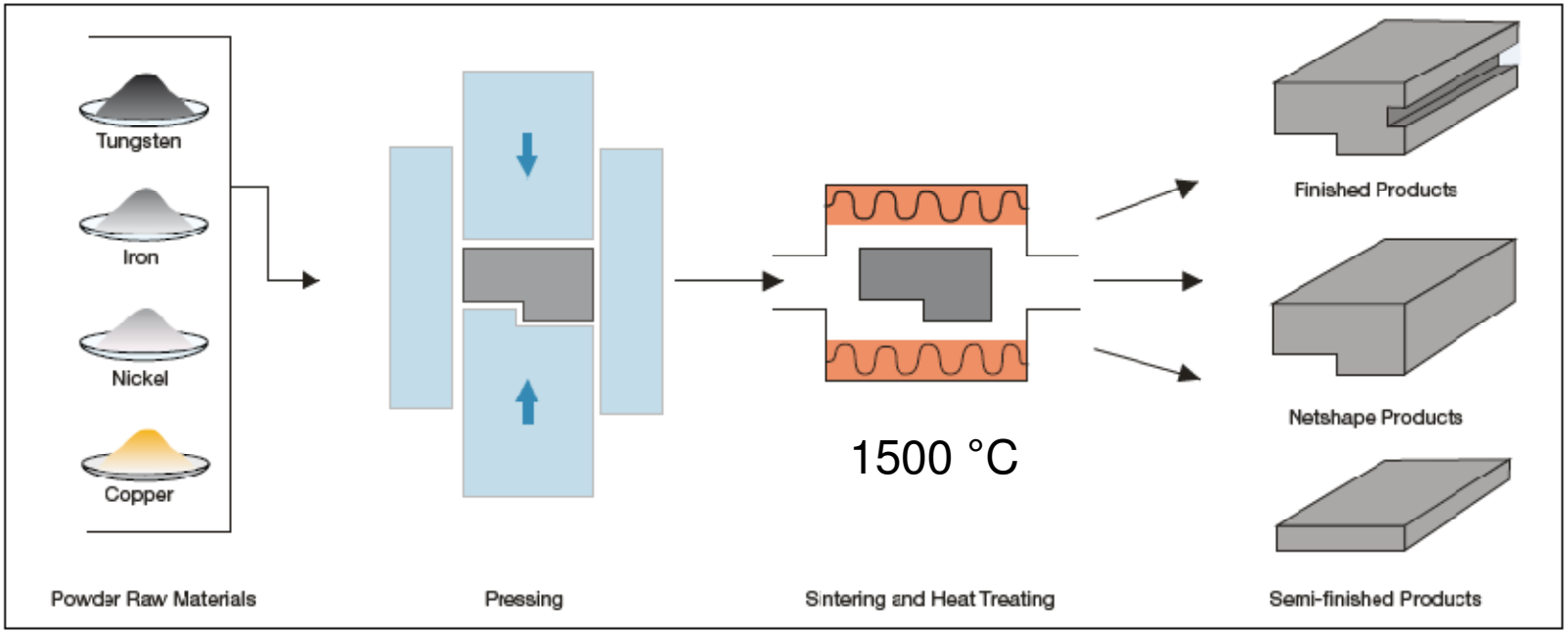
Commercially available Tungsten Plates

Cime Bocuze (St Pierre-en Faucigny, France)

Plansee (Reutte, Austria)

W Composite Material (Cime Bocuze)

- Consist of W (≥ 90%) rest mixture of (Fe), Ni, Cu …
- ρ = 17 – 18 g/cm^3
- $\Lambda \approx 10$ cm, $X_0 \approx 0.4$ cm
- Well established production procedure
- Easy to machine (i.e. sawing/cuting of plates)

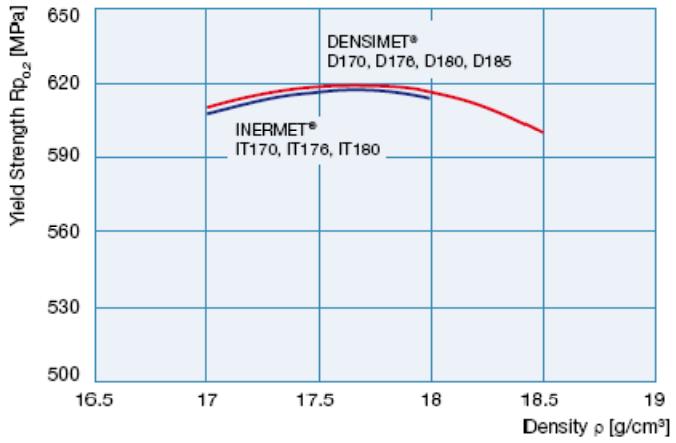


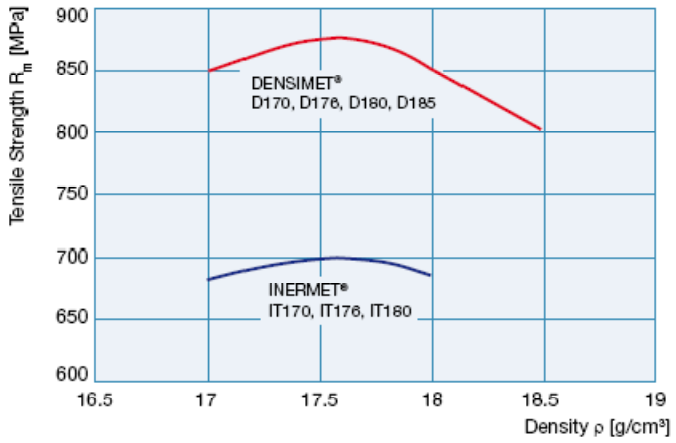
Product Range and Material Properties

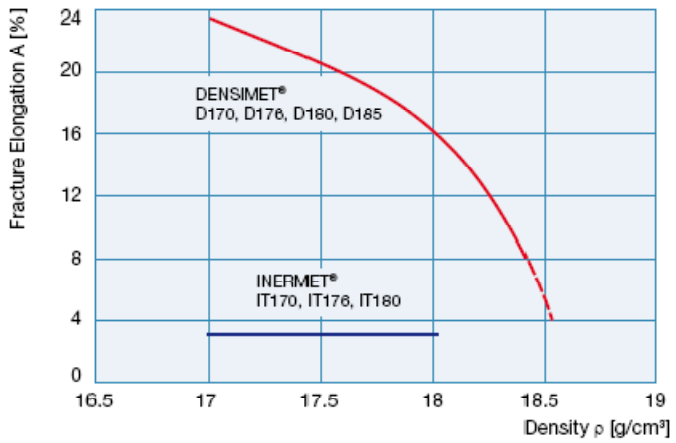
Werkstoff Material	Abkürzung Abbreviation	Chemische Zusammensetzung [%] Chemical composition [%] W	 Rest	Nominelle Dichte Nominal density	AMS-T-21014 Class
Schwach ferromagnetisch / Weakly ferromagnetic					
DENSIMET® 170	D170	90,5	Ni, Fe	17,0	1
DENSIMET® 176 / W	D176 / DW	92,5	Ni,Fe	17,6	2
DENSIMET® 180	D180	95	Ni, Fe	18,0	3
DENSIMET® 185	D185	97	Ni, Fe	18,5	4
DENSIMET® 188	D188	98,5	Ni, Fe	18,8	-
DENSIMET® D2M	D2M	90	Ni, Mo, Fe	17,2	-
Paramagnetisch / Paramagnetic					
INERMET® 170	IT170	90,2	Ni, Cu	17,0	1
INERMET® 176	IT176	92,5	Ni, Cu	17,6	2
INERMET® 180	IT180	95	Ni, Cu	18,0	3

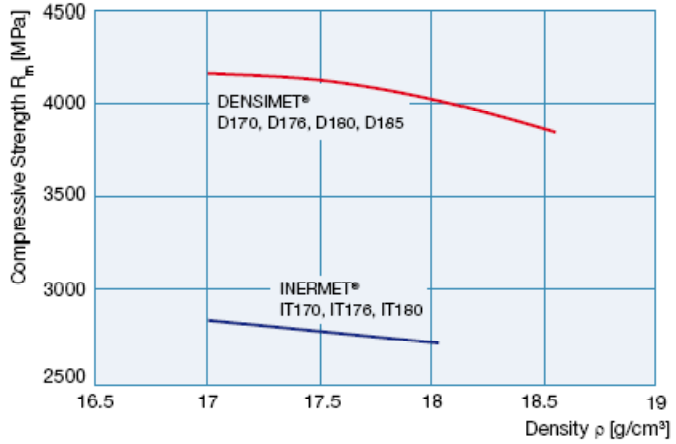
Mechanical Properties

	D170	IT170	D176 / W	IT176	D180	IT180	D185
Elastizitätsmodul E [GPa] Young's modulus E [GPa]	340	330	360	350	380	360	385
Schubmodul G [GPa] Modulus of rigidity G [GPa]	140	125	145	135	150	140	160







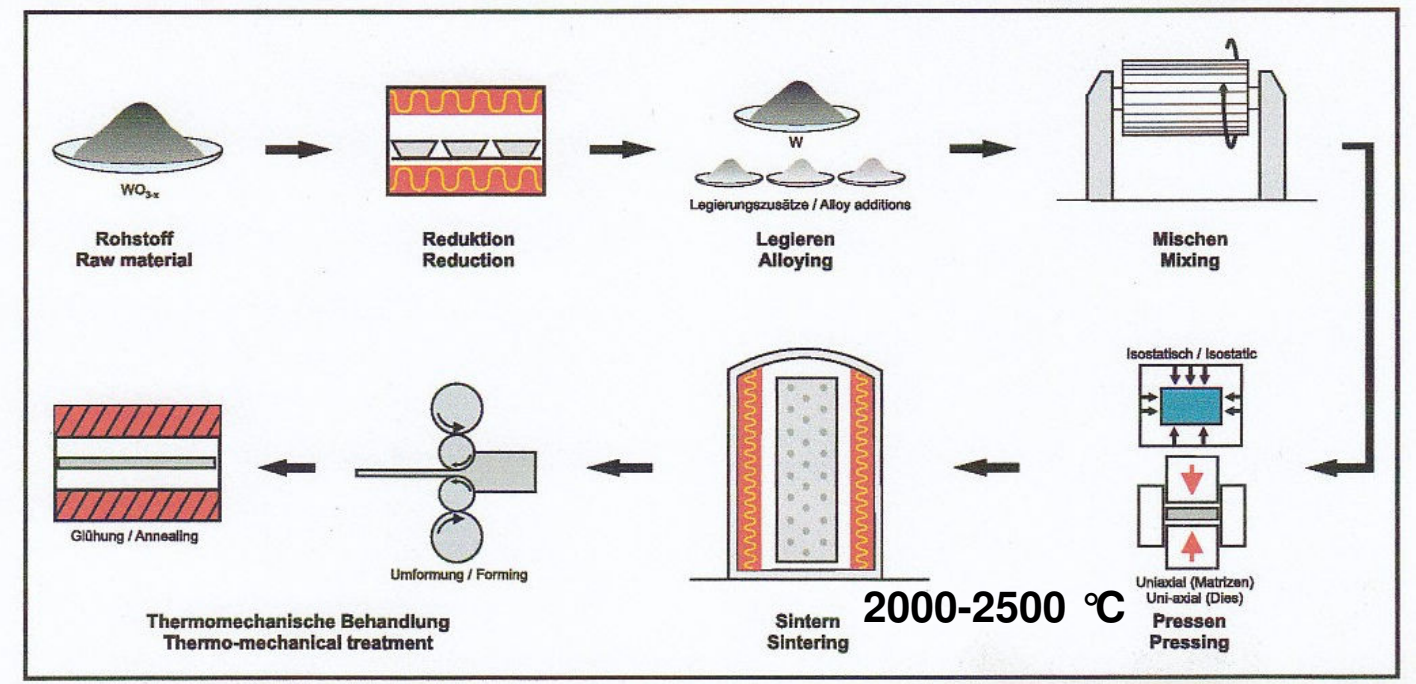


Pure Tungsten Plate Production (Plansee)

Produce ingots (weight ≤ 500kg)

Sintering temp. 2000-2500 °C

Roll to final thickness



Schematischer Ablauf der Herstellung von Halbzeug
Schematic flow of the production of semi-finished products

Mechanical Properties of Pure Tungsten

- Sintered Tungsten exhibits low ductility (is rather brittle) at room temperature.
- Its mechanical properties are situated somewhere between metals and ceramics and are very dependent on small (~ 1%) admixtures (Re, La_2O_3 etc.)
- It's Young's modulus is known (≈2 x E_{SS})
- But it is not easy to get other engineering values like: stress- strain diagram, tensile strength, fracture elongation etc..
- A single load test will not give enough information, other series of measurements are needed;
- Plansee is willing to help us with these values

Comparison of Mechanical Properties

	Pure W	INERMET 176*	Steel
% Tungsten	100	92.5	-
Alloying materials	-	Cu, Ni	-
Elasticity (Young) [GPa]	400	350	200
Density [g/cm^3]	19.3	17.6	7.85
Elongation at yield	< 5%**	5%	30%-50%

*Alloys used must be paramagnetic, **Tests required

Plate size and tolerances

- Currently available plate sizes

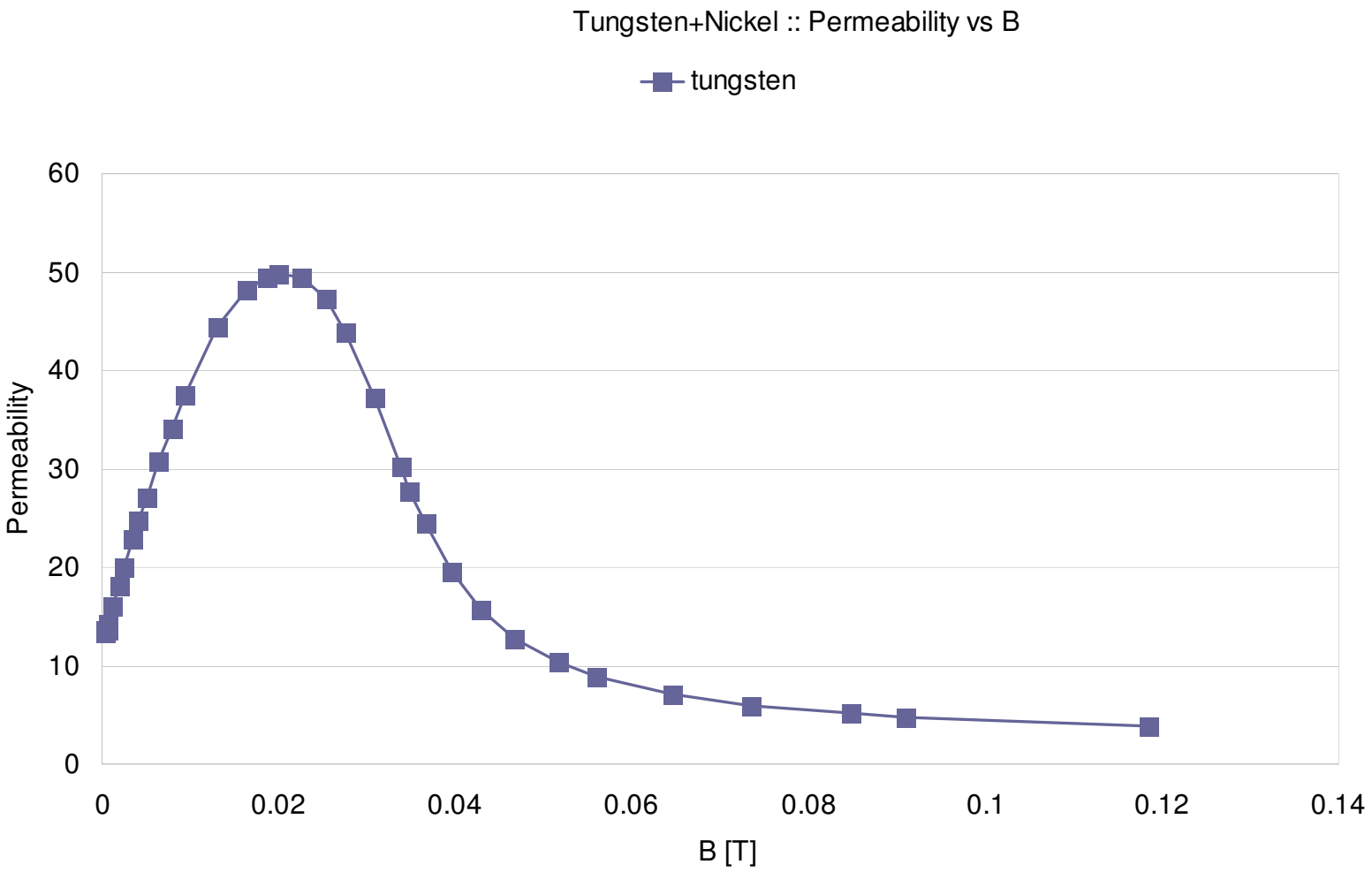
Pure Tungsten	INERMET
1200 mm x 1600 mm	600 mm x 600 mm

- Thickness of 12 mm is feasible for both
- Flatness tolerance ca. 1.5 mm
  - ≤ 1 mm possible
- Thickness tolerance ± 0.5 mm
  - With machining ± 0.1 mm (cost ↑)

Machinability

- Abrasive water jet cutting is suitable
- Holes, slots & various cut-outs are possible
- Precision of ± 0.1 mm is possible
  (but very expensive)

Magnetic properties of Densimet 180



Magnetic properties of Densimet 180