Titanium
Technical Datasheet

Standards	ASTM B 348 DIN 17850 / 17851		Compostion (Reference values in weight %)									
			Al	C	Fe	Sn	Ti	V	O	N	H	Residuals
Short name / Material-No.	Titan Gr1	3.7025	-	max. 0,06	max. 0,15	-	Rest	-	max. 0,12	max. 0,05	max. 0,013	< ,010 / 0,40 *)
	Titan Gr2	3.7035	-	max. 0,06	max. 0,20	-	Rest	-	max. 0,18	max. 0,05	max. ,013	< ,010 / 0,40 *)
	Titan Gr3	3.7055	-	max. 0,06	max. 0,25	-	Rest	-	max. 0,25	max. 0,05	max. 0,013	< ,010 / 0,40 *)
	Titan Gr4	3.7065	-	max. 0,08	max. 0,30	-	Rest	-	max. 0,30	max. 0,05	max. 0,013	< ,010 / 0,40 *)
	Titan Gr5	3.7165	5,5 6,75	max. 0,08	max. 0,30		Rest	3,5 4,5	max. 0,20	max. 0,05	max. 0,10	< ,010 / 0,40 *)
*) each / summary	Titan Gr6	3.7175	4,5 5,5	max. 0,08	max. 0,50	2,0 3,0	Rest	-	max. 0,2	max. 0,05	Max. 0,02	< ,010 / 0,40 *)

Material properties	Titanium belongs to the group of light weight metals. The two most useful properties of this metal are corrosion resistance against oxidizing mediums and the highest strength-to-weight ratio of any metallic material. Titanium properties can be adapted for several applications by using different alloying elements.

Applications:	• Targets for PVD hard coating • Electrodes und anodes for the metal electrolyses (Cu, Ni, Co, Zn) • Stirrer, pumps, valves, frames in the chemical industries • Lightweight sporting equipments (e.g. pitons, ice screws for climbers) • Parts for sport and racing cars and high performance motors • Part for aircrafts and satellites • Implants, bone nails and -screws, in the medical engineering

Mechanical properties (Typical)			Titan Gr1	Titan Gr2	Titan Gr3	Titan Gr4	Titan Gr5	Titan Gr6
	Hardness	HB	120	150	170	200	310	320
	Modulus of Elasticity	kN/mm^2	105	105	105	108	110	116
	Tensile Strength	kN/mm^2	290	390	460	540	920	1000
	Yield Strenght	kN/mm^2	180	250	320	390	870	930
	Elong. (A5–long.)	%	30	22	18	16	8	10
	Red. of Area (long.)	%	35	30	30	25	25	20

Physical Properties								
	Electrical conductivity 293 K (20 °C)	$m/\Omega\ mm^2$	2	2	1,9	1,8	0,6	0,63
	Thermal Expansions-coeffizient (20 – 200 °C) (293-493 K)	1/K	8,7	8,7	8,7	8,7	9,3	9,4
	Thermal conductivity at 20 °C (293 K)	W/m.K	22,6	22,6	2,6	20,1	7,1	6,5
	Density	g/cm^3	4,5	4,5	4,5	4,5	4,43	4,54

Products	Rounds and -flats, sheets, finished parts to drawings , targets

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Machining (gerneral)

Titanium and its alloys have high tensile, toughness and friction properties. Moreover a very low thermal conductivity prevents the heat transfer into the working piece. Therefore the cutting speed should be reduced down to perhaps 1/3 of steel. In this case a high feed rate could be realised. Stabile machines and low chatter tools will improve the machining conditions. Interrupted cut should be avoided. Very good cooling conditions are a base for high yield machining.

Machining datas (Reference values)	Titanium Grade1 to Grade 3	Titanium Alloys
Drilling	HSS* 1.3202	
Cutting speed m/min.	8 - 15	4 - 8
Point angle	90°	90°
Lubrication	Water soluble emulsion	
Turning	Carbides ISO S20 K20 (roughing), S05 (finishing)	
Cutting speed m/min.	80 – 100	20 - 50
Feed rate (mm/U)	0,2 – 0,45	0,2 – 0,45
Rake angle	-6 bis +8°	-6 bis +8°
Clearance angle	75 – 10°	5 -10
Lubrication	Water soluble emulsion, high pressure if possible	
Milling	Carbides ISO S20 K20 (roughing)	
Kind of milling	Down milling preferred	
Cutting speed m/min.	80 – 120	
Chip angle	6 - 10°	
Clearance angle	10 – 12°	
Angle of inclination	6 - 10°	
Lubrication	Water soluble emulsion, as much as possible	
Grínding	Silicon Carbide wheels	
Harness	H, J, K, L	
Grain	40 - 120	
Strukture	medium	
Bond	ceramic	
Cutting speed m/sec.	5 - 12	
Lubrication	Water soluble emulsion, as much as possible	

All statements as to the properties or utilization of the materials and products mentioned in this datasheet are only for the purpose of description. Guarantees in respect of the existence of certain properties or utilization at the material mentioned are only valid if agreed upon in writing.

*(HSS) High Speed Steel