

MOLYBDENUM POWDER METALLURGY PRODUCTS

Number PD-7008 Issue 0-28.10.2004

MOLYBDENUM ALLOY PBT Powder Metallurgy Bar

Description of Product This specification covers molybdenum alloy (Molybdenum + 0.5 % titanium

+ 0.1 % zirconium) wrought bar produced from pressed and sintered powder

metallurgy billet.

Chemical Characteristics¹⁾

(Mass fraction in % [cg/g]; ppm [µg/g])

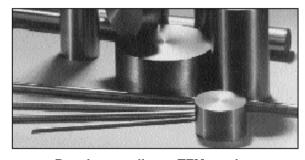
The chemical composition of the molybdenum blended powder used for producing the wrought bar shall conform to the following limits:

Mo(By Difference)	min.		99.2	%
С	0.010	-	0.040	%
*N (Sintered Material)	max.		0.002	%
*O (Sintered Material)	max.		0.040	%
Fe	max.		0.010	%
Ni	max.		0.005	%
Si	max.		0.005	%
Ti	0.40	-	0.55	%
Zr	0.06	-	0.12	%

^{*}Unless method of analysis is agreed upon, deviations from these limits alone shall not be cause for rejection.

Structure

Bars can be supplied in the recrystallized condition upon request.



Powder metallurgy TZM products

¹⁾ Information on testing methods on request.



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Mechanical Properties

The hardness shall conform to the following range, as measured at mid-radius location:

Diameter Inches	mm	Hardness, Minimum	DPH (10 kg) Maximum	
1/8 to 7/8	3.2 - 22.2	255	320	
Over 7/8 to 1 1/8	22.2 - 28.6	245	310	
Over 11/8 to 17/8	28.6 - 47.6	240	300	
Over 17/8 to 2 7/8	47.6 - 73.0	235	290	
Over 27/8 to 3 1/2	73.0 - 88.9	230	285	

All sizes of recrystallized bar shall exhibit hardness (mid-radius) of 215 DPH maximum.

Tensile tests are conducted at room temperature (65°F to 85°F [20°C - 30°C]) with test specimens made and tested to Specification ASTM E-8, using a strain rate of 0.002 to 0.005 in/in/min through 0.6 % offset and 0.02 to 0.05 in/in/min to fracture.

Tensile properties in the longinudinal direction, using such specimens taken from the center of round bars Up to 1 ¼ inch diameter and from mid-radius location for larger bars, shall meet the following minimum values:

Diameter Inches	mm	Tensile Strength Minimum	Yield Strength (0.2 % Offset) Minimum	Elongation % Minimum
1/8 to 7/8 Over 7/8 to 11/8 Over 11/8 to 17/8 Over 17/8 to 27/8 Over 27/8 to 31/2	3.2 - 22.2 22.2 - 28.6 28.6 - 47.6 47.6 - 73.0 73.0 - 88.9	KSI MPa 115 790 110 760 100 690 90 620 85 585	100 690 95 655 85 585 80 550	% 18 15 10 10

Diameter		Diameter Varia	ation	Out-of-Round
Inches	mm	Inches	mm	Inches mm
1/8 to 9/32 Over 9/32to 13/32 Over 13/32to 5/8 Over 5/8 to 7/8 Over 7/8 to 1 Over 1 to 1 3/8 Over 13/8 to 11/2 Over 11/2 to 15/8 Over 15/8 to 2 41.3 Over 2 to 2 1/2	3.2 - 7.1 7.1 - 10.3 10.3 - 15.9 15.9 - 22.2 22.2 - 25.4 25.4 - 34.9 34.9 - 38.1 38.1 - 41.3 - 50.8 + 0.030 50.8 - 63.5	+0.002 -0.002 +0.003 -0.003 +0.010 -0.005 +0.015 -0.005 +0.020 -0.005 +0.020 -0.010 +0.020 -0.015 +0.025 -0.015 -0.020 +0.76 +0.032 -0.032	+0.05 -0.05 +0.07 -0.07 +0.25 -0.13 +0.38 -0.13 +0.51 -0.13 +0.51 -0.25 +0.51 -0.38 +0.64 -0.38 -0.51 0.025 +0.81 -0.81	0.004 0.10 0.006 0.15 0.012 0.30 0.015 0.38 0.015 0.38 0.018 0.46 0.020 0.51 0.020 0.51 0.64 0.025 0.64
Over 21/2 to 31/2	63.5 - 88.9	+0.032 -0.032	+0.81 -0.81	0.027 0.69

Special finished bars can be supplied with a tolerance of \pm 0.002 inch for 2 inches diameter or smaller sizes, and \pm 0.005 inch for larger size bars.

Maximum variation from straightness will be 0.050 inch per foot.

Maximum variation in cut length will be + 1/4 inch, -0.



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Special and Surface/ Internal Condition

Bars can be supplied to ASTM 387-90.

Bars will be supplied with chemically or mechanically cleaned surfaces. Minor surface imperfections, revealed by dye penetrant inspection, may be removed by conditioning, provided such removal does not reduce dimensions

below specified tolerance limits.

Identification Bar will be identified with an appropriate lot number. Each shipping container will

be marked with the name of the customer and the purchase order number.

Hazards identification in Advertising (Directive 67/548/EEC Article 26, Directive 1999/45/EC Article 13

and REGULATION (EC) No 1272/2008 Article 48)

none.

Reports A product certification report that details pertinent chemical, mechanical,

structural and physical integrity features will be provided.

Rejection H.C. Starck must receive written notification of rejected material with the resaon

for rejection. The right is reserved to inspect rejected material at customer plant for claim validation. The material may be returned only after proper authorization.

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