

**TZM-Sheet****Information about the content**

<b>Responsible area:</b>	Plansee SE	<b>Prepared/Updated:</b>	See SAP-DMS
<b>Valid from:</b>	03-May-2021	<b>Released:</b>	See SAP-DMS
		<b>Controlled:</b>	PSE-020

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*This specification covers sheets made of TZM, a Mo-alloy with Ti, Zr and C – including sheet cuts.*

**1 Dimensions and tolerances****1.1 Thickness and width tolerances****Cold rolled sheets**

Thickness [mm]	Thickness tolerance [mm]	Maximal width [mm]	Width tolerance [mm]
0,30 – < 0,50	± 0,028	300	± 1,0

**Hot rolled sheets**

Thickness [mm]	Thickness tolerance [mm or % of the thickness]	Maximal width [mm]	Width tolerance [mm]
≥ 0,50 – 0,60	± 0,06	650	± 1,6
> 0,60 – 0,80	± 0,08	650	± 1,6
> 0,80 – 1,00	± 0,08	700	± 1,6
> 1,00 – 1,50	± 0,13	800	± 2,0
> 1,50 – 2,00	± 0,15	850	± 2,0
> 2,00 – 3,60	± 0,18	850	± 2,0
> 3,60 – 50,0	± 5 %	1000	± 2,0

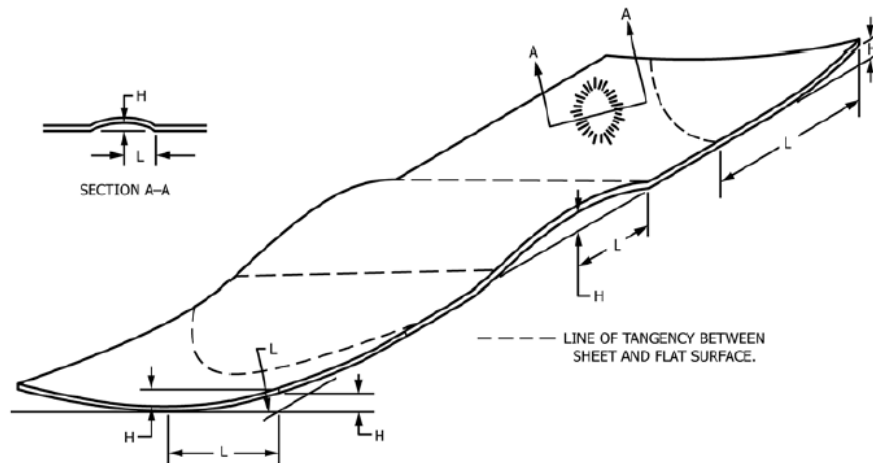
**1.2 Length tolerance**

The length tolerance for sheet length is maximal + 5 mm and – 0 mm.

The maximum sheet dimensions depend on the sheet thickness. Other dimensions upon request.

**1.3 Flatness**

**Flatness:** max. 4 % (measuring procedure on the basis of ASTM B 386)



Flatness Deviation, % =  $(H/L) \times 100$   
 H = maximum distance between flat surface and lower surface of sheet.  
 L = minimum distance between highest point on sheet and point of contact with flat surface.

### 1.4 Sheet cuts

These cuts are being produced from the sheets described in (1.1).

**a) Tolerances for sheet cuts:**

- Thickness ≤ 15 mm: DIN-ISO 2768 Part 1 Tolerance class m (medium)
- Thickness > 15 mm: DIN-ISO 2768 Part 1 Tolerance class c (coarse)

**b) Flatness:**

The same specified limits as defined for sheets (see 1.3) apply for the sheet cuts.

**c) Proportion of length to width:**

The length and/or the width must in any case exceed the thickness, maximal width 1000 mm.

Length [mm]	Minimal width [mm]
20 - 400	20
> 400 - 1000	40
> 1000 - 2000	60

**d) Discs and Rings:**

Stated below, minimal ring width, minimal hole diameter 3 mm.

Diameter* [mm]	Minimal width for rings [mm]
≥ 15 - 50	4
> 50 - 100	10
> 100 - 500	15
> 500 - 1000	20

\* Diameter for discs, external diameter for rings

Other dimensions on request.

## 2 Physical and mechanical product properties

### 2.1 Product properties

<b>Density:</b> <sup>a)</sup>	$\geq 10,1 \text{ g/cm}^3$
<b>Vickers Hardness:</b> <sup>b)</sup>	220 – 320 HV

<b>Tensile Test:</b> <sup>c)</sup>	Thickness [mm]	Tensile Strenght min. [MPa]	0,2% Yield Strenght min. [MPa]	Elongation min. [%]
	0,30 – 1,00	700	600	5
	> 1,00 – 2,50	700	600	10
	> 2,50 – 5,00	700	600	12
	> 5,00 – 20,00	650	600	10
	> 20,00 – 50,00	550	470	5

a) The density cannot be determined with sufficient accuracy for small material thickness below 1 mm. Due to the high degree of deformation during production, it is assumed that the theoretical density (above given value) is achieved.

b) The actual value quoted in certificates corresponds to the mean-value of a representative control sample.

c) Samples are taken crosswise to the last rolling direction.

**Remarks:** All TZM-sheets are delivered in stress relieved condition

### 2.2 Surface condition

<b>Appearance:</b>	<p>The material will be of uniform quality, free from foreign matter, splits and fractures. Bed sheets (not trimmed) may have small edge cracks.</p> <p>Surface defects are assessed in the frame of visual inspection.</p> <p>Local surface defects can be removed by grinding within the specified thickness tolerance.</p>
<b>Surface condition:</b>	pickled (dull)

### 3 Chemical composition

Main and minor components	Plansee		Standard	EU- Directive
	Content [%]		ASTM B386 (364)	RoHS <sup>a)</sup>
<b>Mo</b>	Balance <sup>b)</sup>		Balance	-
<b>Ti</b>	0,40 - 0,55		0,40 – 0,55	-
<b>Zr</b>	0,06 - 0,12		0,06 – 0,12	-
Impurities	Max. values [µg/g]		Max. values [µg/g]	Max. values [µg/g]
	Typical	Guaranteed		
Al	1	10	-	-
Cr	3	20	-	-
Cu	2	20	-	-
Fe	5	20	100	-
K	6	20	-	-
Ni	1	10	50	-
Si	2	20	50	-
W	169	300	-	-
C	-	100 - 400	100 – 400	-
H	-	10	-	-
N	5	10	20	-
O	130	500	500	-
Cd	1	5	-	100
Hg <sup>c)</sup>	-	1	-	1000
Pb	-	5	-	1000
Cr (VI)	-	-	-	1000
Organic impurities (e.g. PBB, PBDE, PFOS, PFOA)	- **)	- **)	-	1000

a) EU-directives 2015/863/EU, 2011/65/EU and 2000/53/EC.

b) Metallic purity without W

c) Initial value

\*\*) The presence of Cr (VI) and organic impurities can definitely be excluded because of the production process (multiple heat treatments at temperatures above 1000 °C in H<sub>2</sub>-atmosphere).

The chemical composition is checked by means of random sampling. The sampling inspection plan, analysis and evaluation methods are determined in the internal instruction PSE-020-WI-003. The application of the measured values for the chemical analysis is defined in PSE-680-WI-001.

**Remarks:** The specified physical and chemical characteristics are disclosed not regarding measurement accuracy.

## 4 Packaging, labelling, storage and certification

### 4.1 Packaging, labelling and storage

#### *Standard individual packing:*

Depending on their size, the sheets will be either packed individually or in parcels with liner between the different pieces.

*Each package will be provided with a label with the following information:*

<b>Producer's name:</b>	Plansee
<b>Plansee order number:</b>	
<b>Lot number:</b>	
<b>Material number:</b>	
<b>Material:</b>	TZM
<b>Dimension:</b>	e.g. thickness, width, length, diameter, etc.
<b>Quantity:</b>	Total quantity in kg or piece
<b>Date:</b>	

The material must be kept in a dry place and protected from mechanical damage. It is best to keep the sheets in their original packing until used.

*Special packing:* (extra costs will be invoiced)

Special packing should be used if the material is stored under unusual conditions or aggressive atmosphere (e.g. sea air, ...).

### 4.2 Inspection documents

Following inspection documents will be supplied upon customer request according to EN 10 204:

#### *Test report*

Plansee confirms with this test report that the delivered product meets the specification and gives details of the material properties according to ongoing production surveillance, not directly related to the particular production batch.

*Inspection certificate* (extra costs will be invoiced)

An inspection officer from Plansee confirms with this inspection certificate that the delivered product meets the specification and gives test results related to the particular production batch.

## 5 Order instructions

Please quote following information when ordering:

- Product description
- Quality (the number of this specification must be mentioned)
- Dimension: thickness (width, length, diameter, etc.)
- Quantity (total quantity in kg or in piece)
- Required certificate and content in case of a 3.1 inspection certificate
- *For special packing:* Specification of packaging

For further information on our delivery possibilities, please look into our <http://www.plansee.com>

## 6 Referenced standards

The standards applied for the test methods are listed in the Plansee standard infobase and are made available upon request.

### Changes to last version

Replacement for	Changes to last version
03	<ul style="list-style-type: none"><li>▪ Section 3: Table 2 chemical composition, header "min. content" to "content"</li><li>▪</li></ul>