Industrieverband
Halbzeuge und Konsumprodukte
aus Kunststoff e.V.

pro-K Fluoropolymergroup

Technical brochure 05

Tolerances for sintered PTFE-products

Status: December 2013

Industrieverband Halbzeuge und Konsumprodukte aus Kunststoff e.V.

Preamble

The fully fluorinated polymer PTFE is the most widely used fluoropolymer and based on its unique properties is established as an indispensable construction material in modern industries.

The main extraordinary properties of PTFE are resistance to most chemicals, a broad service temperature range, the excellent electrical properties, resistance to embrittlement, ageing resistance and very high purity.

This technical brochure provides information on the tolerances for sintered products made from PTFE, which are essential for high quality PTFE products.

This brochure replaces and in parts respectively augments the brochure „quality requirements, test guidelines and tolerances“ for PTFE products edited in 1993 by the „Gesamtverband Kunststoffverarbeitende Produkte” (GKV).

Important note:

This brochure is provided for information only. The information given herein has been prepared according to our best knowledge at this time. The author and pro-K do not provide any warranty for its correctness and completeness. Each reader has to make sure that the information is suitable and appropriate for his or her purpose.

Status December 2013

Fluoropolymergroup

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1. Field of application

The tolerances listed in this technical brochure are valid for filled and unfilled PTFE products as well as for reprocessed PTFE.

2. General

All measurements shall be performed at a „standard atmosphere" at 23°C and 50 % air humidity.

2.1. Skived films and sheets

Thickness	Tolerance
< 0,1 mm	+0,01 mm/ -0 mm
≥ 0,1 mm	+10 % / -0 %

The standard tolerance for width is +3 %/ -0 %, maximum 30 mm.
The standard tolerance for length is +2 %/ -0 %.
For surface roughness the tolerance is ≤ 0,8 µm

Edge waviness

A PTFE-skived film of the length L and the width B is placed on a support plate.
A parallel flat plate is placed over the highest point of the sheet. For practical purposes this can also be done by spanning of two cords.
The determination of the maximal tolerated waviness of the edge is performed according to the test method described in DIN ISO 1101.

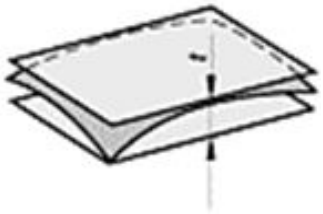

Figure 1 Edge waviness (from DIN ISO 1101 (University Essen / Duisburg, ipe)

Flatness tolerance

The film must lie between two parallel planes with a separation “t.” The following maximum values of t are allowed:

	Thickness of film (mm)	width (mm)	t (mm) normal film
Standard PTFE	≤ 2,5	600	30
		1000	50
		1200	60
		1500	80
	≤ 5,0	600	40
		1000	60
		1200	70
		1500	90
Modified PTFE	≤ 2,5	600	30
		1000	60
		1200	70
		1500	90
	≤ 5,0	600	55
		1000	70
		1200	85
		1500	110

Option: Straightness of edge

The PTFE-skived film of length L is placed without strain on a plane support.
The starting point and end point of the film are connected by a straight line. Parallel to this line a second parallel line is drawn at a distance of C.
The bent edge of the film must always be between the two lines.

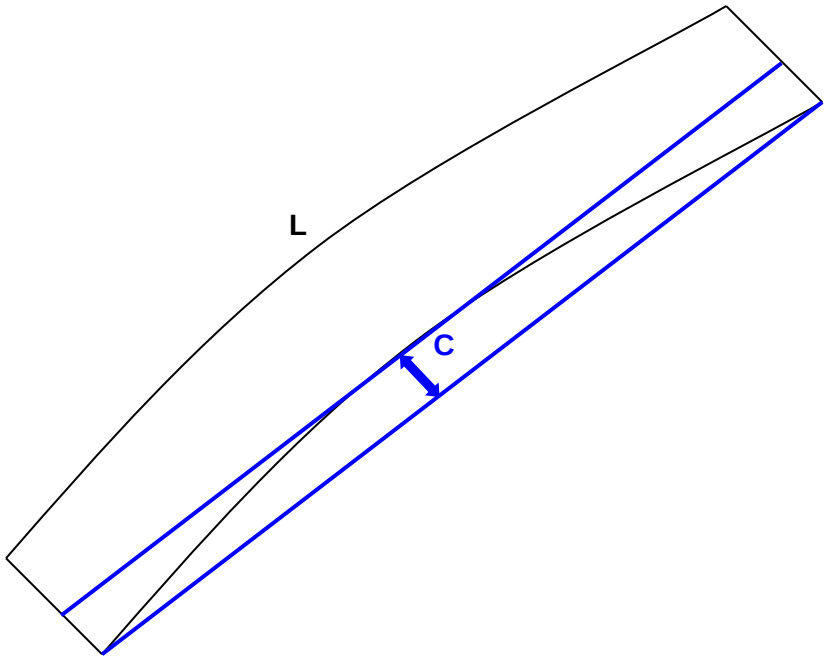

Figure 2: Straightness of edge

The straightness of edge is usually not part of general quality specifications.
For films of the thickness ≤ 5 mm the following guideline may be applied:

	C in % of L
Standard PTFE	3
Modified PTFE	5

Contamination

The determination of the contamination is done by a visual inspection of the surface. Contaminations adhering to the surface caused by the machining are not taken into account.

The following criteria may be regarded as a recommendation for the assessment.

Moulded sheets and thick films

The quality of semi-finished goods is defined by the following table:

Sheet/film dimensions	Description
600 x 600 mm	2 inclusions per side With a maximum diameter of 1 mm
1000 x 1000 mm	3 inclusions per side With a maximum diameter of 2 mm
1200 x 1200 mm 1220 x 1220 mm	4 inclusions per side With a maximum diameter of 2 mm
1500 x 1500 mm	5 inclusions per side With a maximum diameter of 2 mm

Thin skived films

For this kind of films higher requirements apply. These have to be agreed on between the customer and the supplier.

Moulded parts

The quality of semi-finished products is defined in the following table:
The number of contaminants applies to mouldings up to a diameter of 400 mm and to a length of 300 mm or mouldings above Ø 400 mm and a length of 100 mm.

Dimensions	Description
up to Ø 100 mm. (Ø D);	2 inclusions With a maximum diameter of 1 mm
above Ø 100 to 300 mm (Ø D)	3 inclusions With a maximum diameter of 1 mm
above Ø 300 mm (Ø D)	3 inclusions With a maximum diameter of 1 mm

Extruded parts

The quality of semi-finished products is defined in the following table:
(Length 1000 mm)

Dimensions	Description
from Ø 4 to Ø 40 mm (Ø OD)	2 inclusions With a maximum diameter of 1 mm per rod / pipe
above Ø 40 to Ø 80 mm (Ø OD)	3 inclusions With a maximum diameter of 1 mm per rod / pipe
above Ø 80 mm (Ø OD)	4 inclusions With a maximum diameter of 1 mm per rod / pipe

Quality control via determination of the mechanical properties

Information about the mechanical properties is provided in the technical brochure 4 „Quality requirements and test guidelines for PTFE products“, edited in December 2012 by pro K.

2.2. Moulded sheets

Thickness	Tolerance
< 5 mm	+0,75 / -0 mm
≥ 5 mm	+15 / -0 %

The tolerance with regard to length and width is +3 / -0 %, maximum 35 mm.
The surface roughness shall be ≤ 10 µm.

Requirements regarding the **planeness** of moulded sheets are not defined.
If necessary these parameters have to be agreed on between the customer and the supplier.

2.3. Extruded and moulded rods, extruded tubes (Ram-Extrusion)

For this process only a plus-tolerance on diameter of rods is defined, which is 10 % independent from the diameter. The standard tolerance for extruded and moulded rods as well as for extruded tubes (Ram-Extrusion) with respect to length is:

Length	Tolerance
< 500 mm	+10 / -0 mm
≥ 500 mm	+2 / -0 %

The tolerance for diameter for ground rods requires a separate agreement.

Diameter tolerance (inside and outside) for extruded tubes

Outside- Ø	Tolerance	
	Inside- Ø	Outside- Ø
< 10 mm	+0 / -0,6 mm	+0,6 / -0 mm
≥ 10 mm	+0 / -6 %	+6 / -0 %

2.4 Diameter - and wall thickness-tolerances for moulded, free sintered tubes

The tolerances for the diameter and wall thickness depend essentially on the length and thickness of the moulded product. The plus tolerance for the outside diameter and the minus tolerance for the inside diameter are higher than in extruded tubes. Only limited lengths can be moulded due to the process and the properties of the resin used. The conditions for processing agreed on between the customer and the supplier have to be met for the complete length of the pipe.

2.5. Paste extruded parts, hoses and pipes

The standard tolerance for the inside- Ø and the wall thickness is:

Dimension	Tolerance
Inside- Ø < 5 mm	± 0,25 mm
Inside- Ø ≥ 5 mm	± 5 %
Wall thickness < 1,0 mm	± 0,1 mm
Wall thickness ≥ 1,0 mm	± 10 %

The standard tolerance for the length is +2 / -0 %.

Deviation from the center	
Thickness (mm)	Tolerance (mm)
Up to 5 above 5 to 20 above 20 to 40 above 40	0,3 0,5 1,0 Depending on agreement

Paste extruded tubes

Outside diameter (mm)	Tolerance (mm)
Up to 50 above 50 to 80 above 80 to 125 above 125 to 150 above 150 to 200 above 200 to 250 above 250 to 350 above 350 to 300 above 400	± 2,0 ± 2,5 ± 3,0 ± 3,5 ± 4,0 ± 5,0 ± 5,5 ± 6,0 Depending on agreement

Tolerances for the wall thickness

Thickness (mm)	Tolerance (mm)
Up to 3,0	± 0,3
above 3,0 to 4,0	± 0,40
above 4,0 to 5,0	± 0,50
above 5,0 to 7,5	± 0,6
above 7,5	Depending on agreement

Industrieverband Halbzeuge und Konsumprodukte aus Kunststoff e.V.

The following companies contributed to this brochure:

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www.kudernak.de

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