Product Family Brochure

PTFE Liner Comparison Brochure

From soft and flexible to stiff and rigid, Zeus' diverse portfolio of high-performance, thin-walled catheter liners help device engineers transform today's impossible into tomorrow's reality.

ZEUS®

www.zeusinc.com | support@zeusinc.com

Catheter Liners?
We've Got You Covered.

Liner selection remains the cornerstone of successful catheter design. Generally, the most desired features of a catheter liner are thin walls and low coefficient of friction (high lubricity). Still, for every catheter project, medical device manufacturers must match the application's requirements to the size and mechanical performance properties of the available liner options.

Lubricity -

Multiple materials are available from which a catheter liner may be manufactured, however, despite the number of available options, PTFE largely remains the gold standard for most catheter designs thanks to its exceptional lubricity. PTFE has the lowest coefficient of friction of any polymer – a trait that proves especially useful when considering the inside diameter (ID) of the catheter. Increased lubricity of the catheter ID results in reduced deployment force of intraluminal devices (e.g. stents, balloons, etc.) as they are passed through the catheter's working channel, increasing the likelihood of a successful procedural outcome.

Thin Walls -

In addition to PTFE's low coefficient of friction, its ability to be processed into tubing that possesses extremely thin walls and tight tolerances is another key advantage for catheter design. A catheter liner with extremely thin walls enables designers to maximize the working channel of the catheter while keeping the overall profile of the device to a minimum. Thin walls are also a contributing factor in the strength and flexibility of a catheter – however, beyond just the dimensions of the catheter liner, the actual manner in which the liner is produced plays an important role in its overall performance.

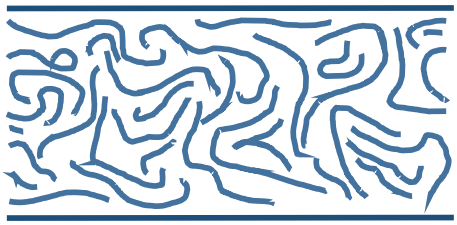
Strength & Flexibility -

Today, multiple production methods exist for producing thin-walled PTFE liners: film cast, free-extrusion, and extrusion over-the-wire (OTW). Each production method results in a catheter liner with somewhat differing features and design considerations. Free-extrusion, for example, causes crystallites within the PTFE matrix to unwind and form fibrils which are oriented in the axial, or extrusion, direction. These fibrils contribute to the strength and rigidity typically seen in free-extruded liners.

Film cast, on the other hand, produces no molecular orientation of the individual PTFE chains. The result is a liner that is more flexible, albeit weaker than comparably sized free-extruded liners. Finally, extrusion over-the-wire results in some molecular orientation, and therefore these liners exhibit features somewhere between that of free-extruded and film cast liners.

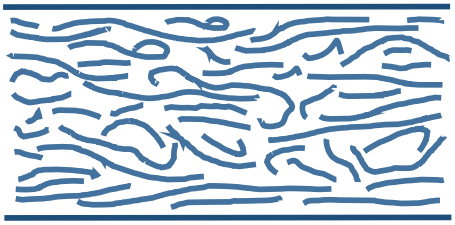
Molecular Orientation –

Film Cast



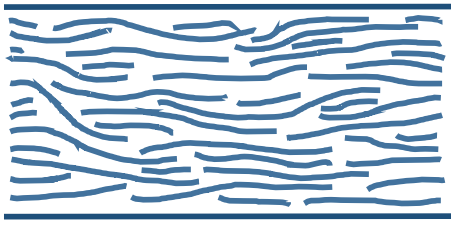
Film cast process provides no molecular orientation of individual PTFE chains

Extrusion Over-The-Wire



Extrusion over-wire imparts some molecular orientation, but not to the extent seen in free-extrusion

Free-Extrusion



Free-extrusion process causes crystallites within the PTFE matrix to unwind and form fibrils in the axial direction

Choosing the Right Liner for Your Next Project

PTFE Sub-Lite-Wall™ Liners

With industry-leading sizing, tight tolerances, and high performance properties, Zeus PTFE Sub-Lite-Wall™ liners are an ideal choice for a wide variety of advanced vascular catheter designs.

- Thin and flexible
- Largest range of ID and wall sizes in the industry
  - *ID's from 0.002" to 0.500" (0.051 mm to 12.7 mm)*
  - *Nominal wall thicknesses from 0.001" to 0.005" to (0.025 mm to 0.127 mm)*
- Available in straight lengths
  - *Max cut length 86" (2184.4 mm)*

PTFE Sub-Lite-Wall™ StreamLiner™

Pairing max wall thicknesses of 0.001" / 0.0254 mm (VT) and 0.00075" / 0.01905 mm (XT) with best-in-class tensile strength, free-extruded StreamLiner™ VT and XT catheter liners enable advanced catheter designs with smaller profiles or larger working channels.

- Thinner and more flexible than Sub-Lite-Wall™ liners
  - *StreamLiner™ VT: Nominal Walls 0.00075" (0.01905 mm)*
  - *StreamLiner™ XT: Nominal Walls 0.0005" (0.0127 mm)*
- Access to smaller, more complex vasculatures
  - *Enhanced flexibility over Sub-Lite-Wall™ liners*
- More design freedom
  - *Maximize working channel or minimize device profile*

PTFE Sub-Lite-Wall™ StreamLiner™ Over-The-Wire

StreamLiner™ Over-The-Wire (OTW) liners provide the same thin walls and tight tolerances as free-extruded StreamLiner™, but with softer, more flexible mechanical performance enabling next-gen designs to navigate the most tortuous vasculatures.

- Thinnest and most flexible extruded liners available
  - *o StreamLiner™ OTW VT: Nominal Walls 0.00075" (0.01905 mm)*
  - *o StreamLiner™ OTW XT: Nominal Walls 0.0005" (0.0127 mm)*
  - *o StreamLiner™ OTW UT: Nominal Walls 0.0004" (0.0102 mm)*
- Access to the most tortuous vasculatures
  - *o Enhanced flexibility over both Sub-Lite-Wall™ liners and Free-Extruded StreamLiner™*
- More design freedom
  - *o Maximize working channel or minimize device profile*

PTFE Sub-Lite-Wall™ Multi-Lumen

As a single, process-ready extrusion, Zeus PTFE Sub-Lite-Wall™ multi-lumen tubing helps simplify steerable catheter construction, reduce manufacturing steps, and improve yields.

- Reduce complex procurement steps and inspection times
  - *o No need to buy 3-5 individual liners*
- Reduce manufacturing steps and speed production
  - *o Eliminate complex tooling*
  - *o No need to glue/assemble/bundle individual liners together*
- Reduce costs and improve yields and efficiency
  - *o PTFE Sub-Lite-Wall™ Multi-Lumens are process-ready*

At a Glance – Free Extruded Liners

		PTFE Sub-Lite-Wall™ Liner	StreamLiner™ VT	StreamLiner™ XT	Streamliner™ OTW VT	StreamLiner™ OTW XT	StreamLiner™ OTW UT	Sub-Lite-Wall™ Multi-Lumen
Process		Free-Extruded	Free-Extruded	Free-Extruded	Extruded Over-The-Wire	Extruded Over-The-Wire	Extruded Over-The-Wire	Free-Extruded
Material		PTFE	PTFE	PTFE	PTFE	PTFE	PTFE	PTFE
Inside Diameter (ID)	in	0.002" to 0.500"	0.004" to 0.120"	0.004" to 0.040"	0.013" to 0.0915"	0.013" to 0.040"	0.013" to 0.020"	0.010" to 0.300"
	mm	0.051 to 12.70	0.102 to 3.048	0.102 to 1.016	0.330 to 2.324	0.330 to 1.016	0.330 to 0.508	0.254 to 7.620
ID Tolerance +/-	in	0.0005" to 0.003"	0.0005" to 0.001"	0.0005" to 0.001"	0.0005"	0.0005"	0.0005"	0.001" to 0.003"
	mm	0.0127 to 0.0762	0.0127 to 0.0254	0.0127 to 0.0254	0.0127	0.0127	0.0127	0.0254 to 0.076
Nominal Wall Thickness	in	0.001" to 0.005"	0.00075"	0.0005"	0.00075"	0.0005"	0.0004"	0.0035" Max Avg
	mm	0.0254 to 0.127	0.01905	0.0127	0.01905	0.0127	0.0102	0.0899 Max Avg
Wall Tolerance +/-	in	0.0005" to 0.001"	0.00025"	0.00025"	0.00025"	0.00025"	0.0002"	N/A
	mm	0.0127 to 0.0254	0.00635	0.00635	0.00635	0.00635	0.0051	
Cut Length	in	86" Max	86" Max	86" Max	86" Max	86" Max	86" Max	86" Max
	mm	2184.4	2184.4	2184.4	2184.4	2184.4	2184.4	2184.4
Surface Treatments		Etched, Tie Layer	Etched, Tie Layer	Etched, Tie Layer	Etched	Etched	Etched	Etched, Tie Layer
Sterilization Methods		Autoclave, EtO	Autoclave, EtO	Autoclave, EtO	Autoclave, EtO	Autoclave, EtO	Autoclave, EtO	Autoclave, EtO
Strength		●●●●●	●●●●○	●●●●○	●●●○○	●●●○○	●●●○○	●●●●●
Flexibility		●●●○○	●●●●○	●●●●○	●●●●●	●●●●●	●●●●●	●●●○○

ACCELERATE
YOUR PROTOTYPING
with FREE SAMPLES of our polymer tubing.

FAST **EASY** **FREE**

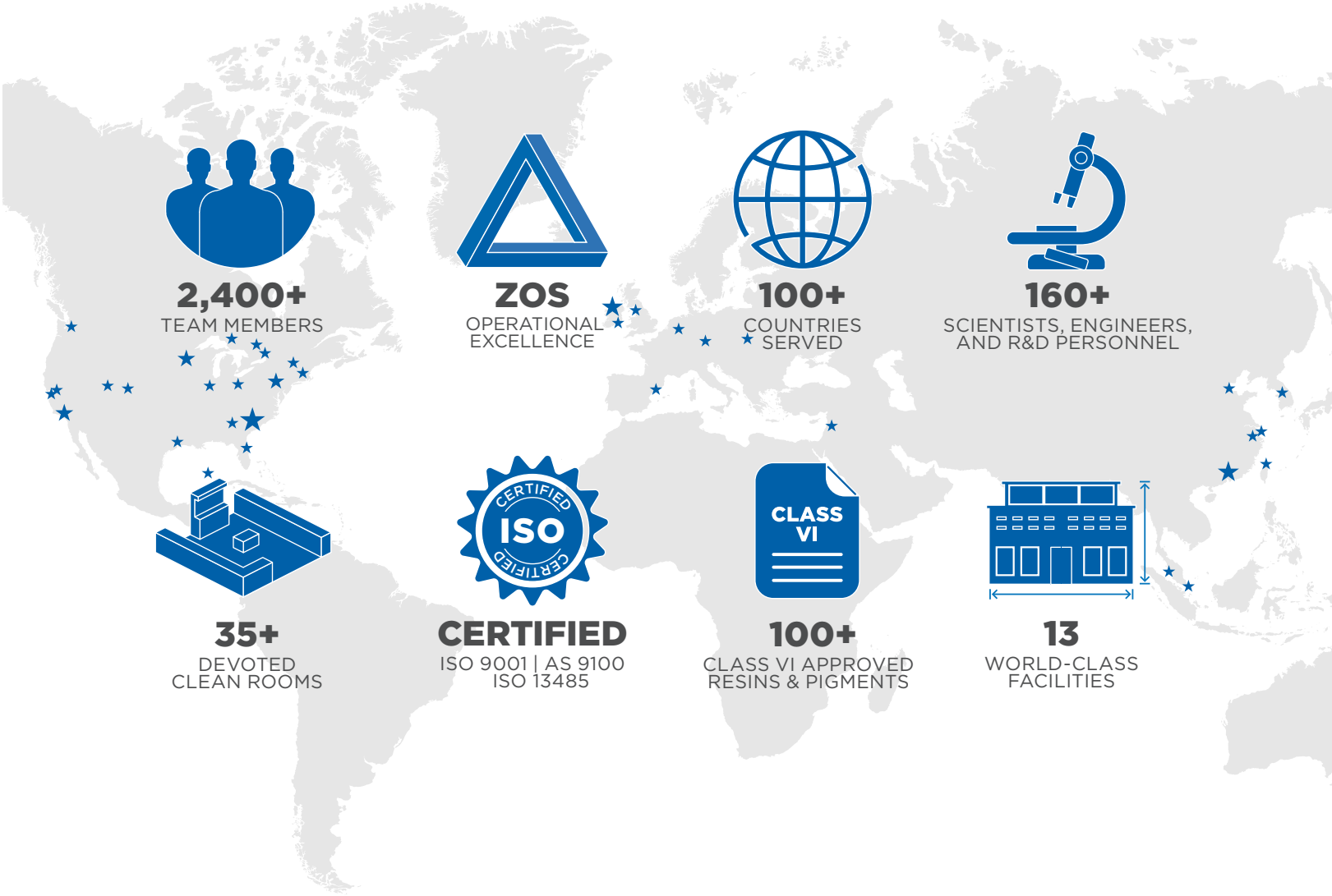
WHY IT'S FAST AND EASY:

1. NO PURCHASE ORDERS OR PAYMENT REQUIRED
2. CHOOSE THE SAMPLES YOU WANT
3. SAMPLES SHIP WITHIN 48 HOURS

GET SAMPLES NOW AT
ZEUSINC.COM/VSL

*For standard delivery please allow 3-5 days for domestic shipments and 6-10 days for international shipments once order has shipped. If expedited delivery is selected a local Zeus customer representative will be contacting you for your freight carrier information.

Get to know Zeus.



2,400+
TEAM MEMBERS

ZOS
OPERATIONAL EXCELLENCE

100+
COUNTRIES SERVED

160+
SCIENTISTS, ENGINEERS, AND R&D PERSONNEL

35+
DEVOTED CLEAN ROOMS

CERTIFIED
ISO 9001 | AS 9100
ISO 13485

100+
CLASS VI APPROVED RESINS & PIGMENTS

13
WORLD-CLASS FACILITIES

OUR MISSION

PROVIDE SOLUTIONS · ENABLE INNOVATION · ENHANCE LIVES

Zeus, headquartered in Orangeburg, South Carolina, is the world's leading polymer extrusion and catheter design manufacturer. With over 55 years of experience in medical, aerospace, energy, automotive, fiber optics, and other leading industries, Zeus's mission is to provide solutions, enable innovation, and enhance lives. The company employs over 2,400 people worldwide with facilities in Aiken, Columbia, Gaston, Orangeburg, and St. Matthews, South Carolina; Branchburg, New Jersey; Chattanooga, Tennessee; San Jose, California; Arden Hills, Minnesota; Guangzhou, China; and Letterkenny, Ireland. For more information, visit *www.zeusinc.com.*

ZEUS®

AMERICAS: +1 803.268.9500 | **EUROPE:** +353 (0)74 9109700 | **ASIA/PACIFIC:** +(86)20-38254906
support@zeusinc.com / www.zeusinc.com