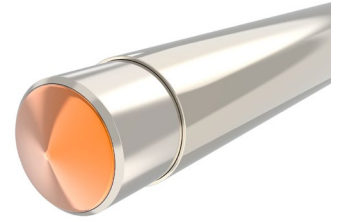


Date: February 15, 2021

Subject: Comparison of Confluent Filmcast PTFE to RAM Extruded PTFE



1.0 Purpose:

The purpose of this memo is to provide data for comparison of Confluent Filmcast PTFE to RAM Extruded PTFE to assist customers in choosing the right material for their specific application.

2.0 Overall Benefits of PTFE:

PTFE is extremely beneficial in medical device manufacturing for a number of reasons, which include its lubricity, low surface energy (prevents biofilm buildup), biocompatibility, chemical resistance (low/no material leachables) extreme temperature tolerance, and ability to be readily sterilized.

	PTFE	Doped Polyimide	Polyimide	Pebax 63D	Vestamid
Coefficient of Friction Dynamic	0.05-0.10	0.30-0.35	0.50	0.27	0.38
Biocompatibility	USP Class VI Compliant				
Operating Temperature	Continuous ≤260°C (500°F)				
Chemical Resistance	Completely inert to attack by virtually all chemicals				
Sterilization	Readily sterilizable by EtO and autoclave				

Data from raw material distributors/ manufacturer’s websites including but not limited to Daikin and Foster.

3.0 Dimensional Comparison:

Filmcast PTFE can be manufactured to very thin wall thicknesses and very tight tolerances, while RAM extruded PTFE can be produced to larger dimensions with greater wall thicknesses.

	ID Range	ID/OD Tolerance	Wall Range
Confluent Filmcast PTFE	0.010”-0.125”	±0.0003”-0.0005”	0.0005”-0.002”
RAM Extruded PTFE	≥0.002”	±0.0005”-0.001”	≥0.001”-0.002” Depending on size

RAM Extruded ranges and tolerances based on Zeus catalog for extruded PTFE and Nordson whitepaper.

4.0 Mechanical Property Comparison:

Filmcast PTFE lends itself especially well to applications requiring increased flexibility while RAM extruded PTFE offers increased stiffness.

	UTS (ksi/MPa)	Elongation(%)	Elastic Modulus (ksi/MPa)
Confluent Filmcast PTFE	4.5/31	910	31/214
RAM Extruded PTFE	8.7/60	410	55/380

These are reference values calculated based on median values from samples tested, which included Confluent 0.1019 ID, 0.001" wall and Zeus Sub-Lite Wall 0.088" ID, 0.0015 wall. The mechanical properties of PTFE are also affected by processing variables and are presented for reference/broad comparison purposes only.

5.0 Processing Comparison:

Both Filmcast and RAM extruded PTFE require surface modification prior to subsequent bonding.

Since Filmcast PTFE is coated over a mandrel, it is extremely well suited for over coating with a single strike layer or multiple layer of construction while maintaining the cost efficiencies associated with a continuous spool-to-spool process. Material can be provided in discrete pieces or on a spool, and the core mandrel can be utilized for subsequent processing without the need for downstream stretching.

How to Leverage Filmcast PTFE with Core Mandrel:

Supplied on a spool or straightened and cut-to-length (see Supply Options)



Mandrel can be used to support liner during braiding or coiling



Extrusion(s) and/or Braid/Coil can be oversleeved for reflow using heat shrink



So unlike extruded PTFE, no stretching or oversleeving of the liner is required. The core mandrel is used throughout, and can be easily removed and discarded to leave behind a high performance finished catheter shaft.

RAM extruded PTFE is most often provided in discrete lengths for subsequent assembly processing utilizing piece-part lamination. It often requires stretching over a stainless steel mandrel that may increase process variability and labor requirements while possibly compromising the integrity of the liner etch.