GRAFT POLYMER
COMBINE INCOMPATIBLE

Polymeric Alloys
Melt Processable UHMWPE

Combination of the best properties of separate materials,
to create the best Co-continuous nano-morphology.

CHALLENGES IN PROCESSING ULTRA HIGH MOLECULAR WEIGHT POLYETHYLENE (UHMWPE)

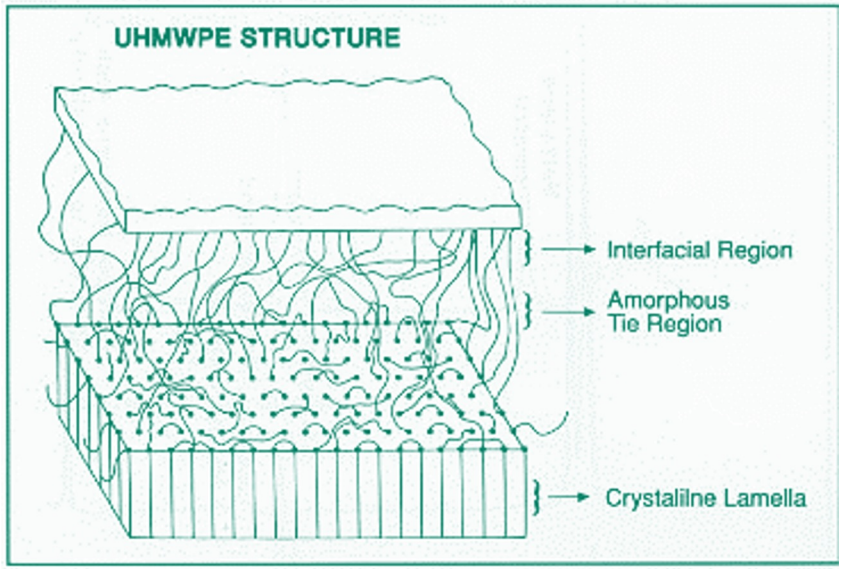
1. UHMWPE is renowned for its exceptional qualities, including:
- *Outstanding physical and mechanical properties*
- *Remarkable impact resistance*
- *Exceptional abrasion resistance*
- *Impressive chemical and radiation resistance*
- *Unrivaled biostability and biocompatibility*

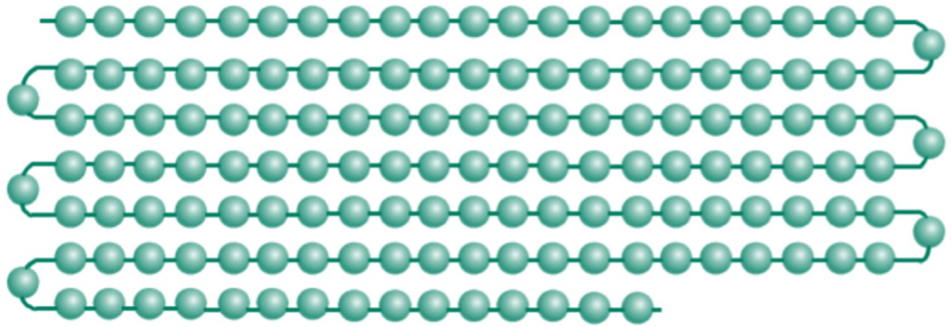
2. Melt-processable UHMWPE presents a substantial challenge due to its unique characteristics, primarily driven by its high melt viscosity.

3. The key factor behind its high melt viscosity is the intricate morphology of its long polymer chains, which resemble a complex and interwoven network.

4. When the material reaches its melt temperature, it assumes the characteristics of a "pseudo-crosslinked gel," making it extremely difficult to mix in its molten state.

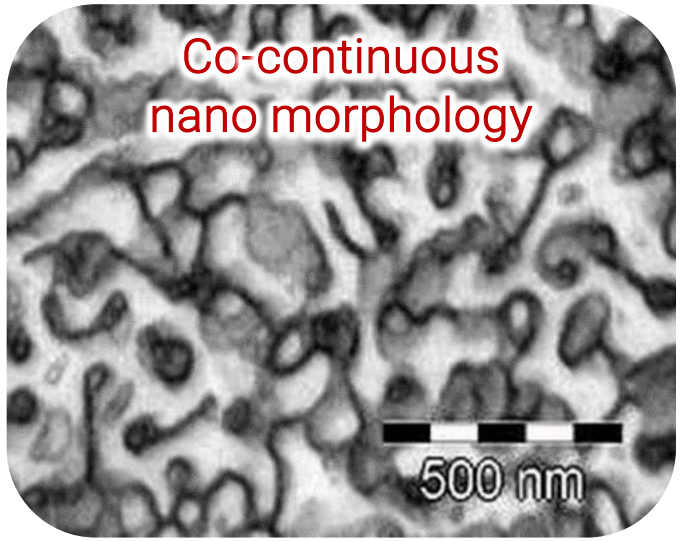
5. This limited "chain mobility" significantly hampers the material's ability to blend uniformly, resulting in end products marked by "fusion defects" and a distinct grainy texture.

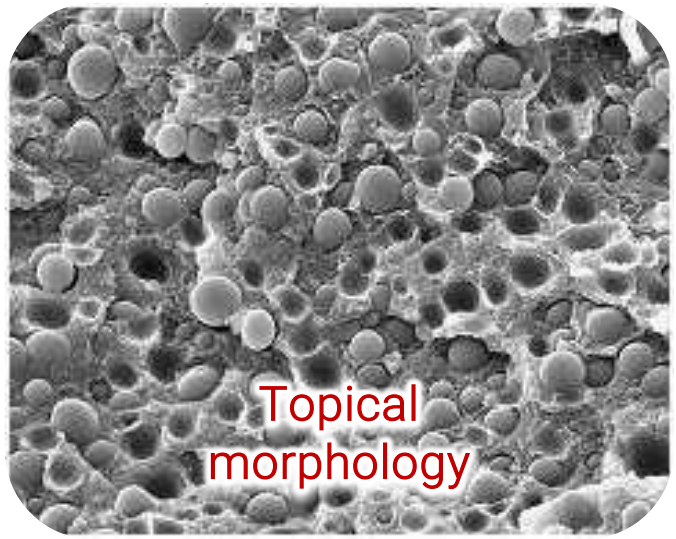




Innovative Breakthrough: Melt Processable UHMWPE Marks a New Era of Solutions

SHAPING UHMWPE WITH "SHISH KEBAB" MORPHOLOGY USING MODIFIED UHMWPE BLENDS





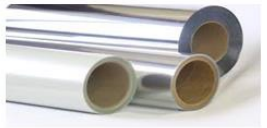
1. Achieving the Unique "Shish Kebab" Morphology of UHMWPE in the Melt
   - *Utilizing Specially Modified UHMWPE Blends*

2. Innovative Extrusion Synthesis Technology for Melt-Processible UHMWPE (MP-UHMWPE)

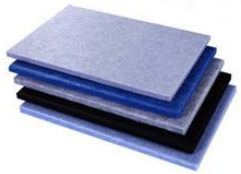
3. Seamless Processing of Granular MP-UHMWPE on Conventional Polymer Equipment:
   - *Extruder*
   - *Injection Machine*
   - *Calendering Sheet Line*
   - *Blown Formation Line*

4. Versatile Technology, Enabling the Production of Concentrated Blends Based on MP-UHMWPE, including:
   - *Thermoplastic Urethanes*
   - *Rubber*
   - *Titanium Nitride*
   - *Etc.*

MAIN APPLICATIONS OF MP-UHMWPE



Films



Sheets
panels

Injection
molding

Pipes

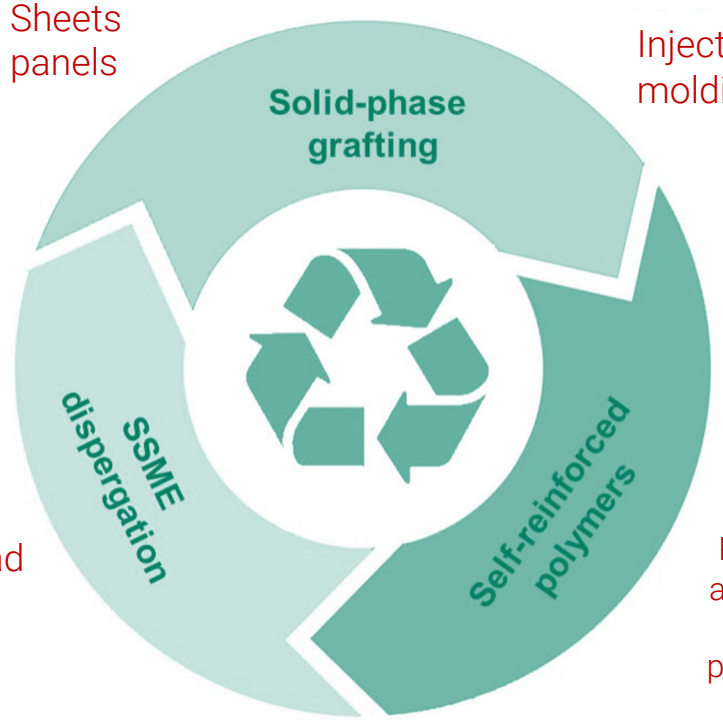
Coatings

Thread

Powder
additives
for
polymers

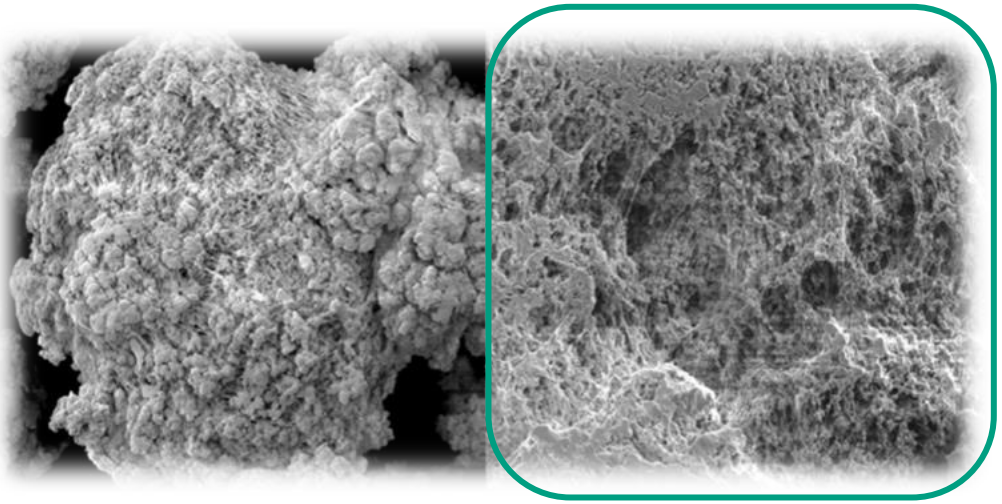
Filament 3D

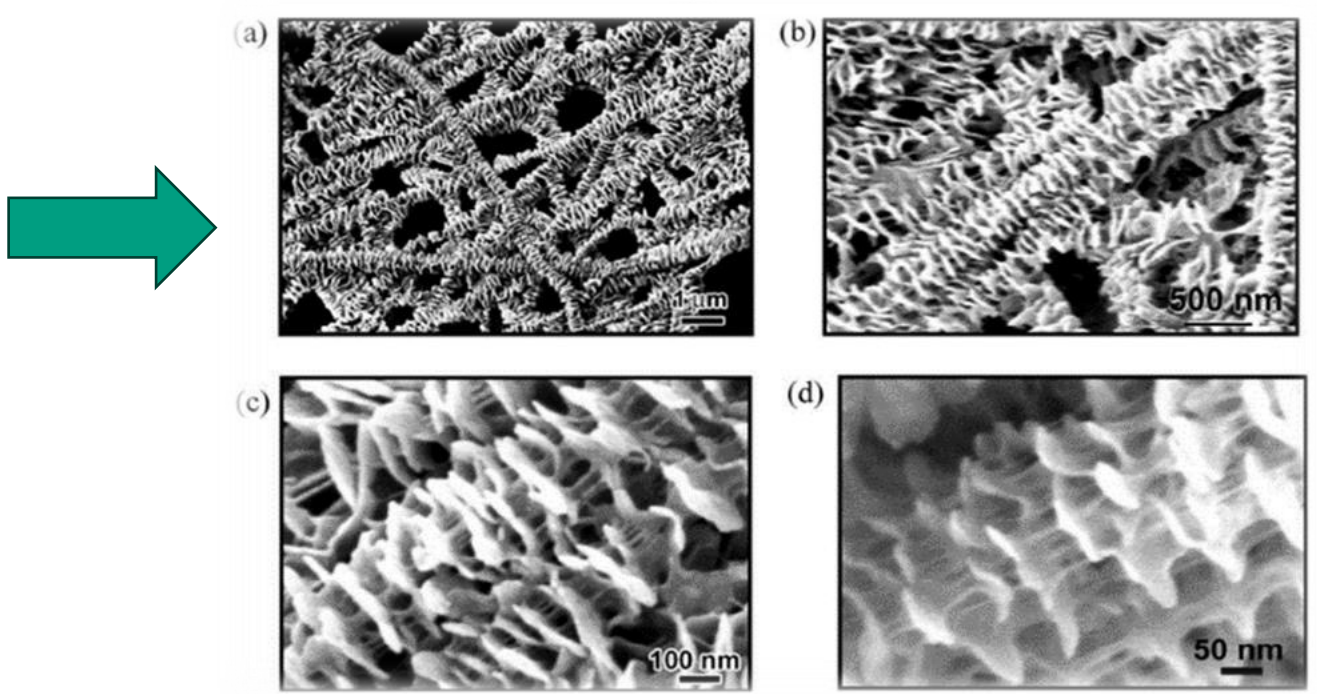
Self-reinforced polymer

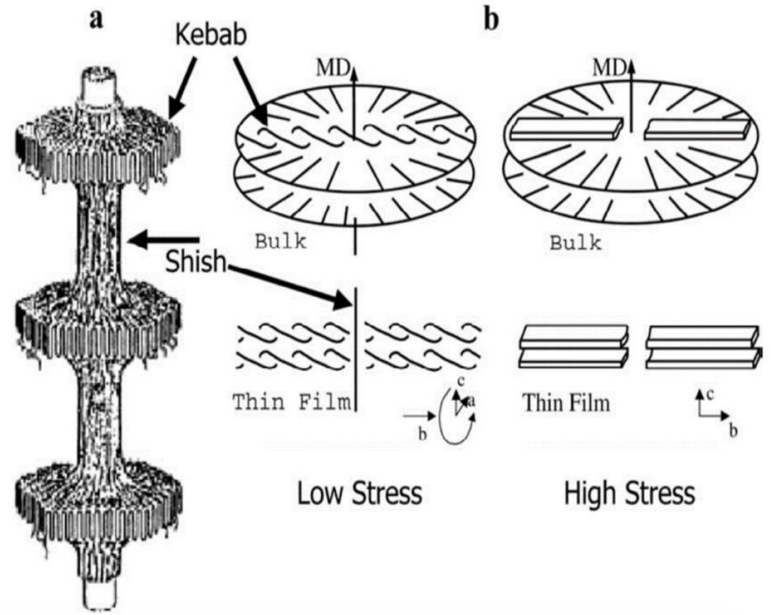


MORPHOLOGY AND STRUCTURE OF MP-UHMWPE

Morphology of standard UHMWPE (*left*) particle and UHMWPE of new generation (*right*).
The grain-structure (*left*) and sponge-structure (*right*) are clearly visible.



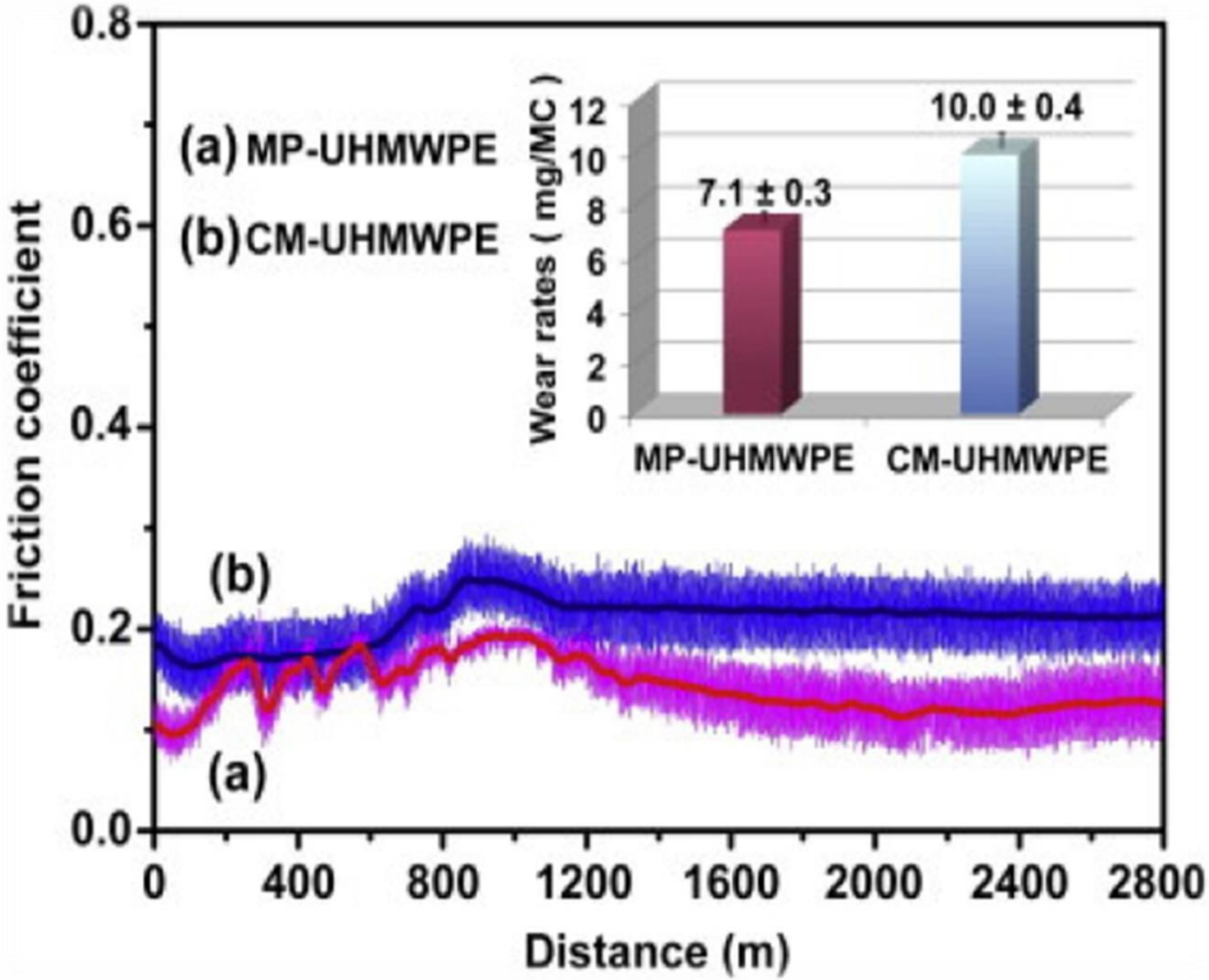




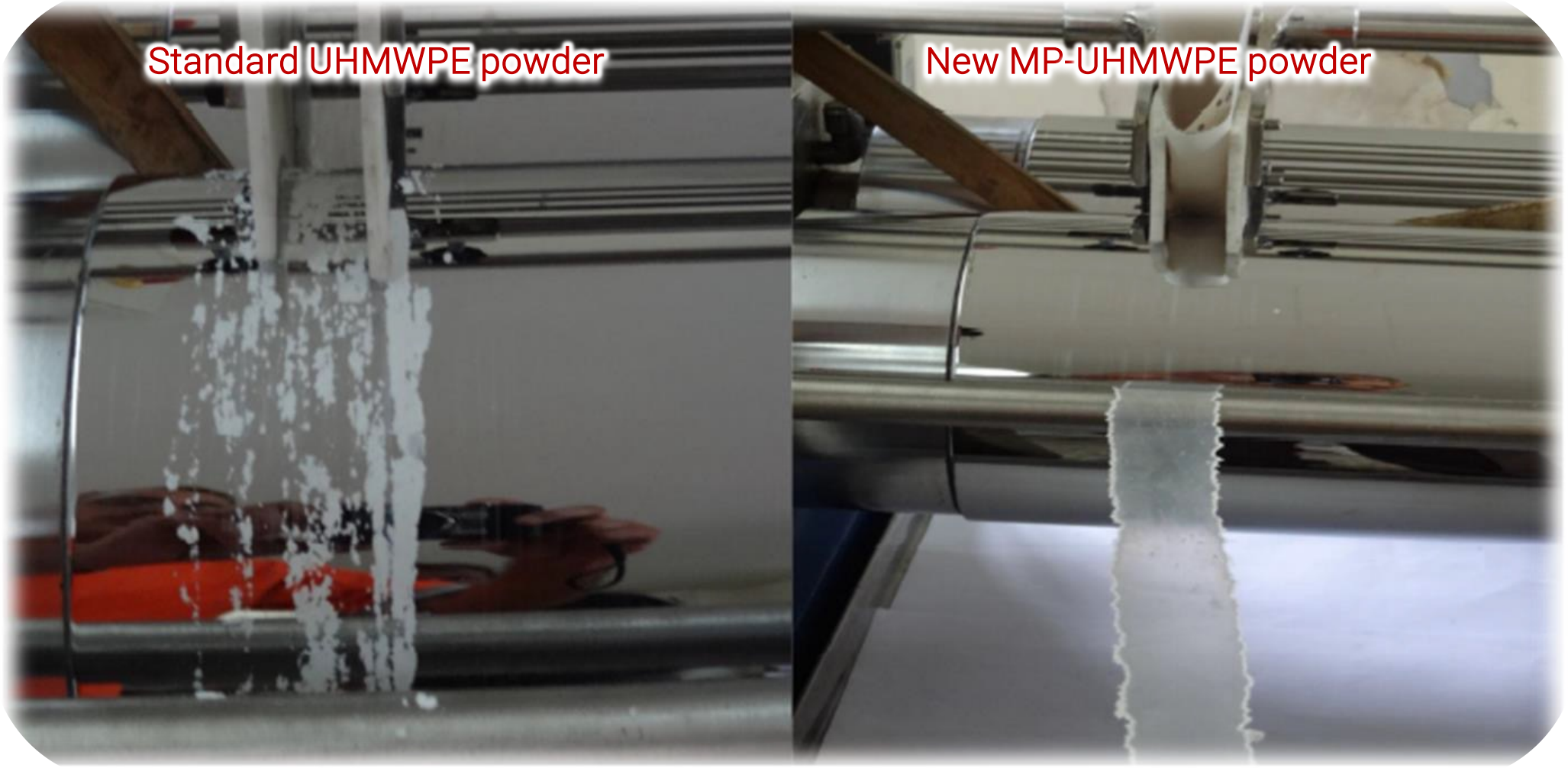
TRIBOLOGICAL PROPERTIES

MP-UHMWPE - Melt processible UHMWPE of new generation.

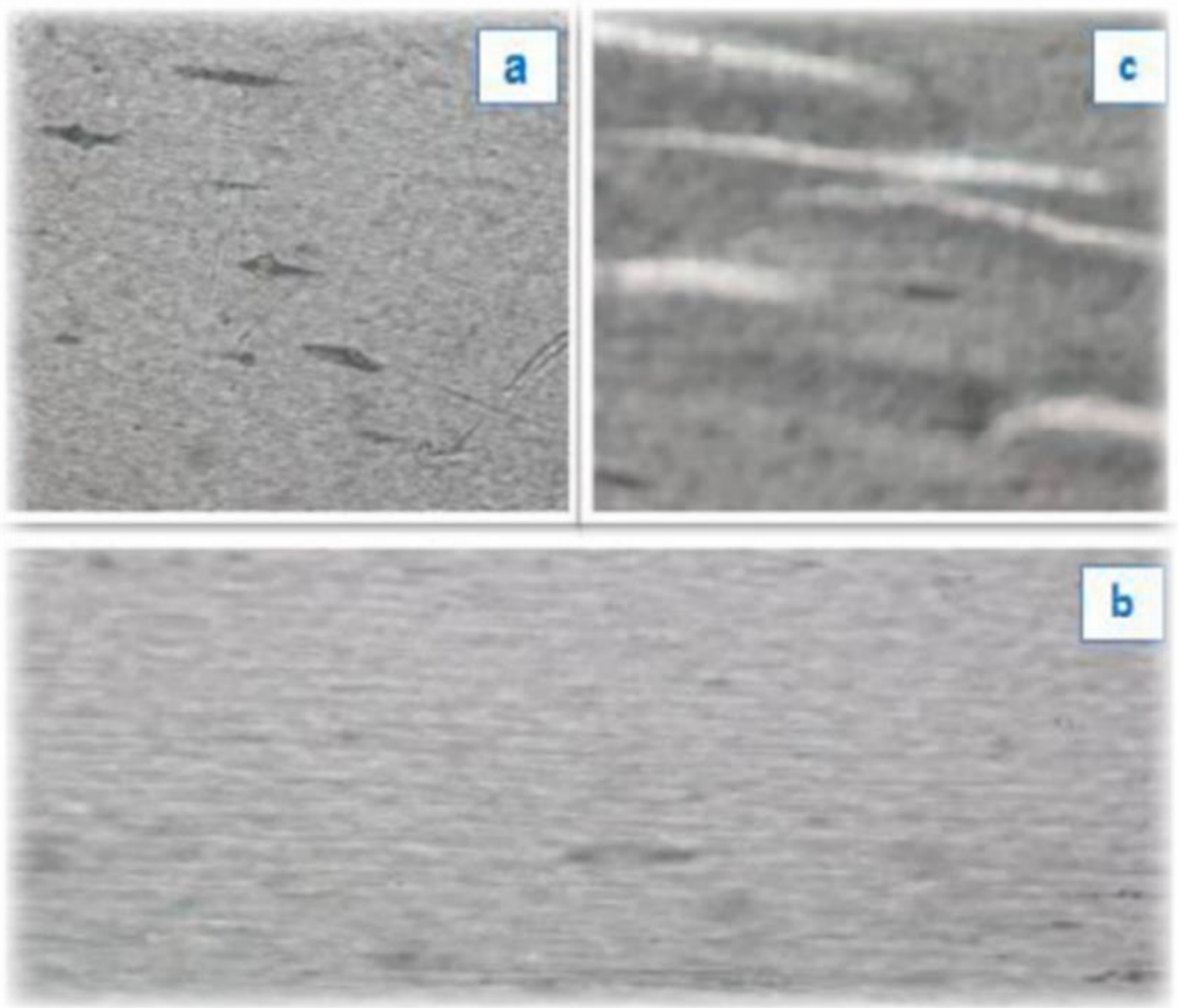
CM-UHMWPE - Standard compression molded UHMWPE.



BEHAVIOR OF THE MATERIALS



DISPERGATION OF NEW MP-UHMWPE IN PURE HDPE (PIPE GRADE)



a) Pure HDPE

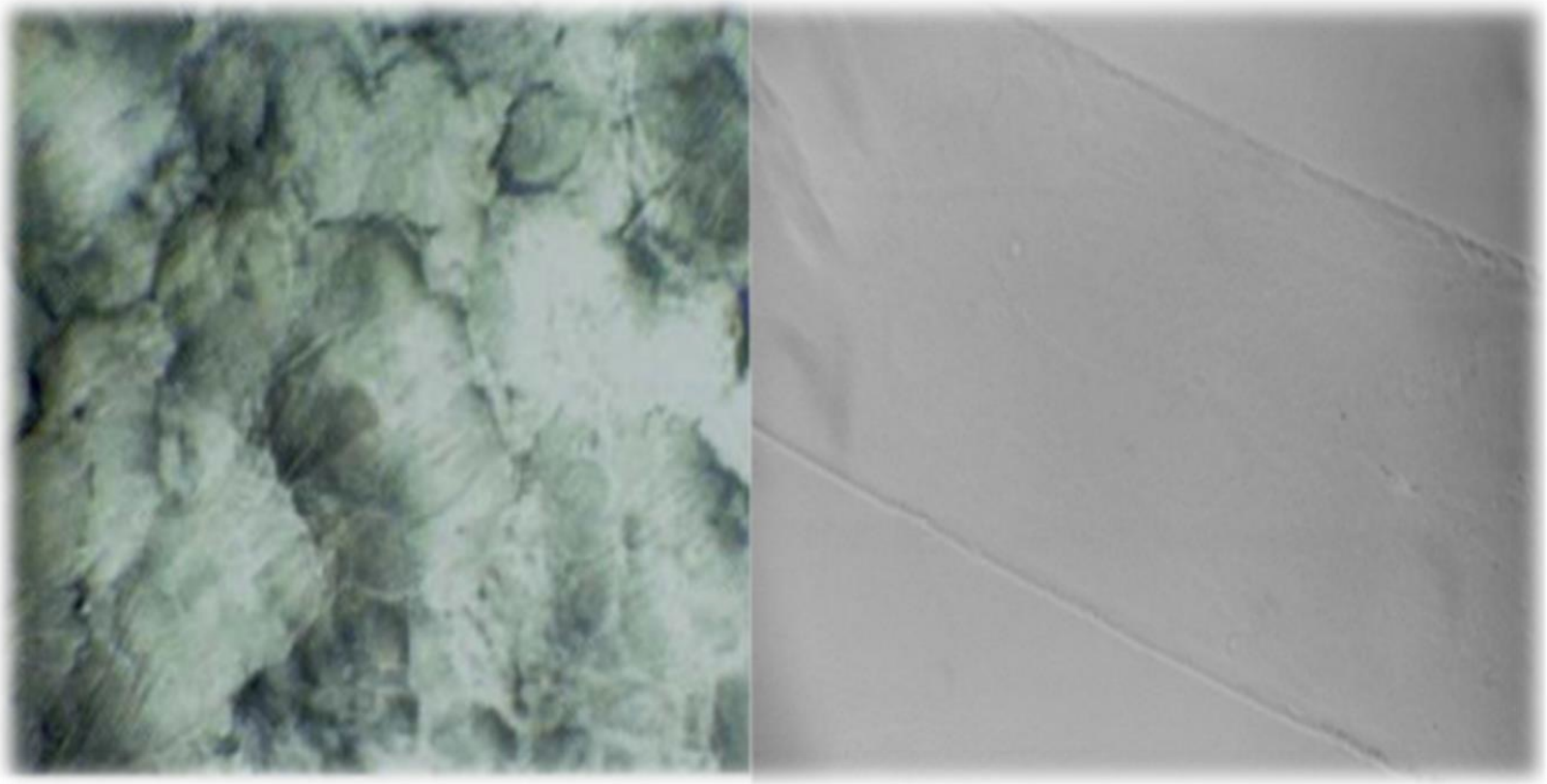
b) HDPE with 10% MP-UHMWPE

c) HDPE with common UHMWPE

MP-UHMWPE in comparison with standard UHMWPE

Standard UHMWPE (left picture – grain structure of the cutoff clearly visible) vs *MP-UHMWPE* (right picture – welds are slightly visible).

This opens up new technological possibilities for the production of sheets and films on standard equipment (separators batteries, filters, etc.)

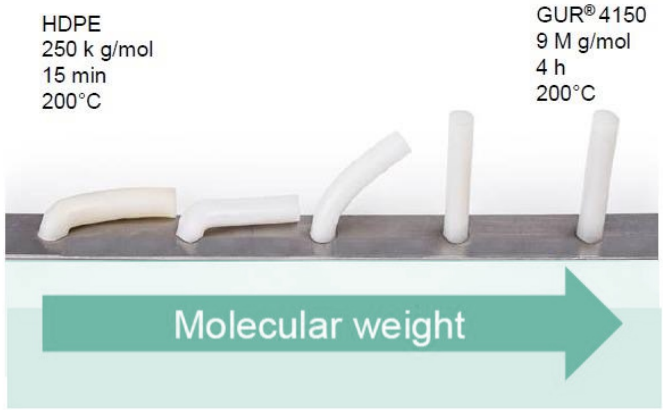


COMPARATIVE PROPERTIES

Characteristic	Standard	Parameters	Units	Standard UHMWPE (GUR 4150)	MP-UHMWPE
Density	ISO 1183	23°C	g/cm^3	930	945
Melt Flow Index	ISO 1133	230°C, 5 kg	g/10 min	/	8,1
Ultimate Tensile Strength	10mm/min		MPa	17	30±2,9
Elongation at break			%	>50	368±33
Charpy impact strength	ISO 179	23°C, 4J, Notched	kJ/m^2	130	NB
		-40°C, 4J, Notched	kJ/m^2	No Data	10±0,5
Shore Hardness	ASTM D2240	D	/	61	60
Vicat softening temperature	ISO 306	50°C/h 50 h	°C	80	123

MAIN PROPERTIES OF MP-UHMWPE

- ✓ Easy Melt Processing: *Utilize standard polymer-processing equipment such as extruders, injection machines, and calenders for a wide range of product types.*
- ✓ Enhanced Physical and Mechanical Properties: *Surpassing standard UHMWPE.*
- ✓ Consistent Tribological Properties: *Comparable to the standard UHMWPE.*
- ✓ Exceptional Biocompatibility: *Ideal for medical applications.*
- ✓ Easy Welding Capability: *In contrast to standard UHMWPE.*
- ✓ High Stretchability: *Offers flexibility in applications.*
- ✓ Compatibility with Different HDPE Grades: *Can be homogenized with various grades of HDPE.*
- ✓ Efficient Solid-Phase Grafting: *Significantly higher efficiency compared to standard UHMWPE, attributed to unique morphology.*
- ✓ Adjustable Porosity: *Default 0%, providing flexibility.*
- ✓ Environmentally Friendly Production: *No use of toxic solvents, ensuring eco-friendliness.*
- ✓ Versatile Color Options: *Easily colored in any desired shade.*



GRAFTALLOY MP-UHHD 00850

GRAFTALLOY™ MP-UHHD 00850 - functions as a toughener, improves mechanical characteristics and increases abrasion resistance.

Special Features and Benefits

- ✓ Improves impact strength and impact resistance
- ✓ It can be used as modifier or as standalone material
- ✓ Very high stiffness

Processing

- GRAFTALLOY™ MP-UHHD 00850 can be processed with all usual processing technologies (Injection molding, extrusion, blow molding, thermoforming, etc.)
- Optimal processing

GRAFTALLOY HD-AR

GRAFTALLOY HD-AR Is a high performance HDPE type, designed to be highly abrasion resistant. This grade contains proprietary co-monomer system to increase abrasion resistance while maintaining HDPE's processability and mechanical properties.

Special Features and Benefits

- Increases abrasion resistance of base materials,
- Widespread use, as it doesn't contain any intrusive chemicals,
- Improves wear resistance.

OUR PRODUCTS WITH UHMWPE

GRAFTALLOY MP-UHSEBS

is a high-performance polymeric alloy, consisting of ultra-high molecular weight polyethylene & thermoplastic elastomer (TPE).

- Improves impact strength and impact resistance while keeping good frictional properties.
- Can be used as a modifier or as standalone material

GRAFT POLYMER
COMBINE INCOMPATIBLE

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