DreamWeaver

The Lowest Cost, Highest Performance Battery Separators Available

Dreamweaver Gold™: When Safety is the Primary Concern

DreamWeaver Gold™ nonwoven battery separators, made from a blend of nanofibers and microfibers and featuring aramid, provide:

- **Improved Safety:** Near zero shrinkage below 300C provides structure and integrity in safety-critical situations.
- **Higher Power:** Higher ionic conductivity results in greater electrode utilization at high C-rates, thereby improving the available power in electric vehicles, power tools and other high performance applications.
- **Better Efficiency:** Reduced internal resistance lowers energy dissipation, increasing efficiency.
- **Higher Energy Density:** More efficient ion transfer allows for flexible battery design with thicker electrodes and reduced separator area, increasing energy density.

Due to these attributes our DreamWeaver Gold separator allows for **thinner, lighter and smaller** batteries. In addition **cost reductions** result from less expensive **separator and battery manufacturing costs.**

The Power of Aramid

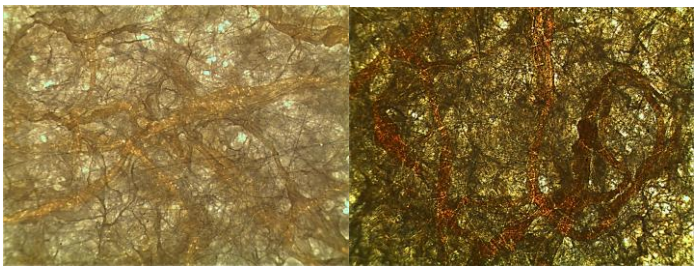
Twaron® aramid fiber has been used for over 30 years to provide structural integrity and thermal and electrical insulation in a wide variety of applications ranging from transformers, generators, printed circuit boards, heat shields and honeycombs, in addition to traditional ballistic and composite applications.

The thermal and chemical stability combined with superior dimensional stability make it the material of choice:

- safely to use in the temperature range of 200 – 300°C
- low shrinkage with no melt point
- low moisture pick-up
- strong with low elongation

Nanofibers and Microfibers

Dreamweaver's patented technology is based on a combination of microfibers and nanofibers. The microfibers provide scaffolding with high strength, thermal stability and an open structure, as can be seen in the SEMs below. The nanofibers drape over the microfibers so the average pore size is low, and the pore size distribution is narrow.

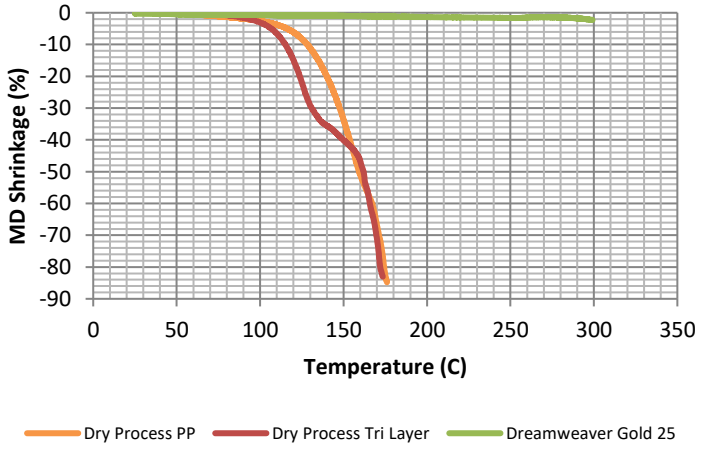


Microfibers: Microfibers by themselves leave a pore size of at least several microns, much too large to be used in lithium ion battery separators.

Nanofibers: Nanofibers by themselves tend to blind and have high resistance to the flow of liquids or ions. They also make extraordinarily weak webs, without the strength required in a high speed battery manufacturing process.

Combined: Combined, the strength and openness of the microfiber scaffolding is attained, while Dreamweaver's proprietary processing ensures that the nanofibers drape over the microfibers strategically, closing down the pore size while maintaining a high permeability to ions

DMA Showing Separator Shrinkage



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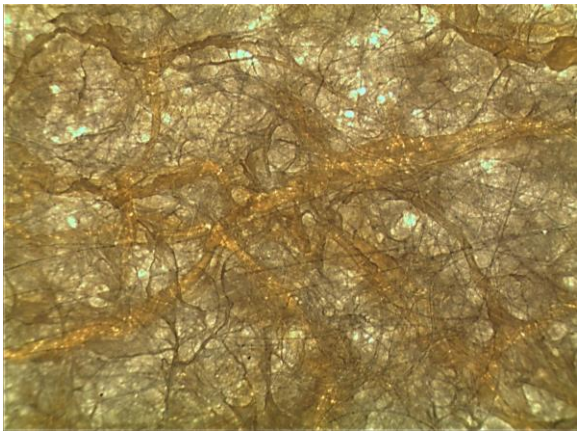
PRODUCT INFORMATION



Name
Dreamweaver Gold™

Description
20 µm Nanofiber Membrane

Primary Application
Lithium Batteries

Product Features
- Aramid fiber for enhanced thermal, chemical and dimensional stability
- <3% shrinkage to 300 C
- High porosity in a uniform, stable sheet
- Good chemical resistance
- Uniform pore structure with narrow pore size distribution
- Excellent wettability; materials wet in just seconds, reducing processing time, and increasing uniformity
- Low electrical impedance and high porosity provide high rate capabilities
- Physical properties closely matched to foil current collectors

Technical Features (Typical Properties)

Basic Membrane Property	Unit of Measure	USABC Requirements	Dreamweaver Gold™ 20
Thickness (12.6 psi)	µm	<25	22
Thickness (25 psi)	µm	<25	21
Gurley (JIS)	seconds		300
Porosity	%		37%
Pore Size	µm	<1.0	0.4
TD Shrinkage @ 280 C/1 Hour	%		1
MD Shrinkage @ 280 C/1 Hour	%		2
TD Strength	Kgf/cm^2		500
MD Strength	Kgf/cm^2	>70	800
Young's Modulus	Kgf/cm^2	>5,000	15,000
Melt Integrity	C	>200	500
Puncture Strength	gf	>300	
Moisture Content	%	<0.0005	6%

Materials may contain up to 7% moisture. Please dry thoroughly before testing; we suggest 150 C for 1 hour for hand sheets and 24 hours for rolls. Due to higher porosity, additional electrolyte may be required. Low electrolyte content may cause high resistivity, shorting or low capacity.

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