

## Technologies



# Ultra high barrier thin film system

## Fast Facts

- Ultra high moisture barrier
- Highly surface conformal
- Optically transparent
- Biocompatible
- Deposition temperature < 90 °C

## General Description

The organic/inorganic thin film system can be applied to polymer substrates to produce ultra-barrier webs or directly to 3D-structures for encapsulation.

## Process properties

- Combination of Parylene CVD with anorganic layers
- Low-temperature processing ( $T_{\max} = 90\text{ °C}$ )
- Substrate size up to 200 x 200 x 7 mm<sup>3</sup>
- Adhesion promotion with plasma or chemical treatment
- No solvent or catalysts required
- Direct coating of sensitive substrates (e.g. organic electronic materials)
- Clean room processing

## Barrier properties

- Optically transparent (> 90 %)
- Total thickness < 3 μm
- Water Vapor Transmission Rate (WVTR) <  $6 \times 10^{-6}$  g/(m<sup>2</sup>d) @ 38 °C, 90 % rH (on PEN substrate, HiBarSens measurement system)
- Water Vapor Transmission Rate (WVTR) =  $1 \times 10^{-4}$  g/(m<sup>2</sup>d) @ 85 °C, 85 % rH (on PEN substrate, HiBarSens measurement system)
- Excellent edge coverage, which prevents edge degradation (of 50 nm Ca @ 30 °C, 90 % rH) and enables direct encapsulation
- Biocompatibility
- Temperature stability of up to 125 °C

## Suggested Applications

- Electronics: protective coatings for MEMS, Microdisplays, circuit boards
- Flexible electronics: encapsulation of OLED, OPD, Perovskite devices
- Medical: biocompatible encapsulation coatings for implantable and non-implantable devices
- Passivation of reactive/ hazardous device components
- Protection of thin film systems against harsh environments

	Parylene				
	N	C	D	F	AF4
Melting point [°C]	410	290	380	> 460	> 500
Continuous temperature [°C]	90	125	160	190	350
Temporary peak temperature [°C]	120	200	300	300	450
Tensile strength [MPa]	45	69	76	52	52
Yield point [MPa]	43	55	62	34	34
Tensile modulus [MPa]	2 400	3 200	2 800	2 500	2 500
Strain to rupture [%]	250	200	200	200	200
Yield strain [%]	2.5	2.9	3.0	2.0	2.0
Density [g/cm <sup>3</sup> ]	1.110	1.289	1.418	1.320	1.320
Dynamic friction coefficient	0.25	0.29	0.31	0.13	0.13
Refractive index	1.661	1.639	1.669	1.559	1.559
Short-term dielectric strength [V/mil @ 1 mil]	7 000	5 800	5 500	5 500	5 500
Dielectric constant @ 1 kHz	2.65	3.10	2.82	2.10	2.20
Dielectric constant @ 1 MHz	2.65	2.95	2.80	2.16	2.17
Gas permeability @ 23°C [(cm <sup>3</sup> x mm)/(m <sup>2</sup> x 24 h x atm)]					
N <sub>2</sub>	7.70	0.37	1.77	4.85	4.80
O <sub>2</sub>	11.81	2.80	12.60	23.50	23.00
H <sub>2</sub>	212.60	43.31	94.49	n/a	n/a
H <sub>2</sub> O [(g x mm) / (m <sup>2</sup> x 24 h)] @ 37°C 90% rH	0.59	0.06	0.10	0.23	0.22
Thermal expansion coefficient [ppm/°C]	69	35	38	36	36
Thermal conductivity @ 25°C [W/(m x K)]	0.120	0.082	n/a	0.096	0.096

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All information contained  
in this datasheet is prelimi-  
nary and subject to change.  
Furthermore, the described  
system is not a commercial  
product.