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EMD PERFORMANCE MATERIALS

barrier formulations

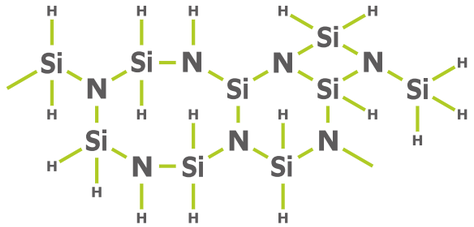
EMD Performance Materials is a business of
Merck KGaA, Darmstadt, Germany

Barrier formulations

We supply polysilazane formulations for special purpose barrier coatings, which can be applied on plastics, glasses and other surfaces. We provide responsive, local support to our customers helping them to rapidly bring advanced barrier coating solutons to the market.

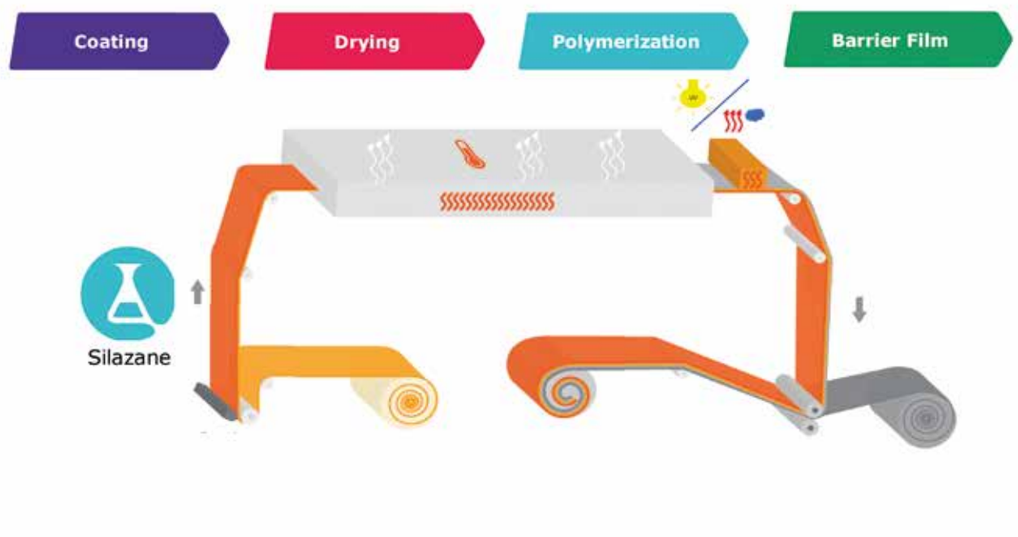
BASIC KNOWLEDGE OF POLYSILAZANES

Polysilazanes are polymers in which silicon and nitrogen atoms alternate to form the basic backbone. Each silicon atom is bound to two separate nitrogen atoms and each nitrogen atom to two silicon atoms as depicted.



FORMULATIONS FOR HIGH PERFORMANCE BARRIER FILMS

As a result of polymerization, polysilazane is transformed into a glass-like layer after processing. This layer makes a barrier against oxygen and water.



KEY FEATURES AND BENEFITS OF EMD'S BARRIER FORMULATIONS

Tunable barrier performance
- Easy to adjust formulation for different target end-markets

Thin layers
- 200~800nm thick

Variety of substrates
- Designed for coating on plastics or glass

Easy processing
- Do not need vacuum processing

MULTIPLE BARRIER LAYERS FOR ACHIEVING HIGHER PERFORMANCE

Single layer
Close to QD requirements

Barrier
Plastic substrate

WVTR ~10^{-3}g/m^2/day

Multiple layers
Laminated stacks of coated films for OPV, OLED etc.

Barriers
Plastic substrate

WVTR ~10^{-4}g/m^2/day

EXAMPLE PERFORMANCE

Single layer, coated barrier films made in EMD's R&D lab. give proof of principle
- Barrier material coated on polyethylenenaphthalate (PEN) substrate
- Water Vapor Transmission Rate (WVTR) was determined at 40°C, 90% relative humidity

	Formulation	Polymerization method	Film Thickness (nm)	WVTR (g/m^2/day)
Reference	PEN substrate	–	–	10^{+1}
Barrier Films	NL120A	UV	250	10^{-3}
	NAX120	Steam	800	10^{-2}

More details available: N. Satake, S. Kawato, Y. Ozaki & M. Kobayashi IDW'13, FLX4-3, pp1549-1550

PRODUCT OVERVIEW

- Polysilazane based materials.
- Coating materials, available for various coating methods.
- Transform to silica glass-like layer.
- Makes inorganic film (no carbon contained).
- Catalyst contained materials, catalyst assists low temperature cure for transformation.

PRODUCT LINE-UP

Products	Outline	Features
NAX120	Lowest temperature cure type Catalyst contained	• Capable to be transformed at room temperature or very low temperature (below 100°C) curing.
NL120A	Mid temperature cure type Catalyst contained	• Needs mid temperature (150~250°C) for transformation. • Capable to be transformed to higher density film than NAX product.
NN120	High temperature cure type Pure PHPS	• Needs higher temperature for curing (over 400°C).