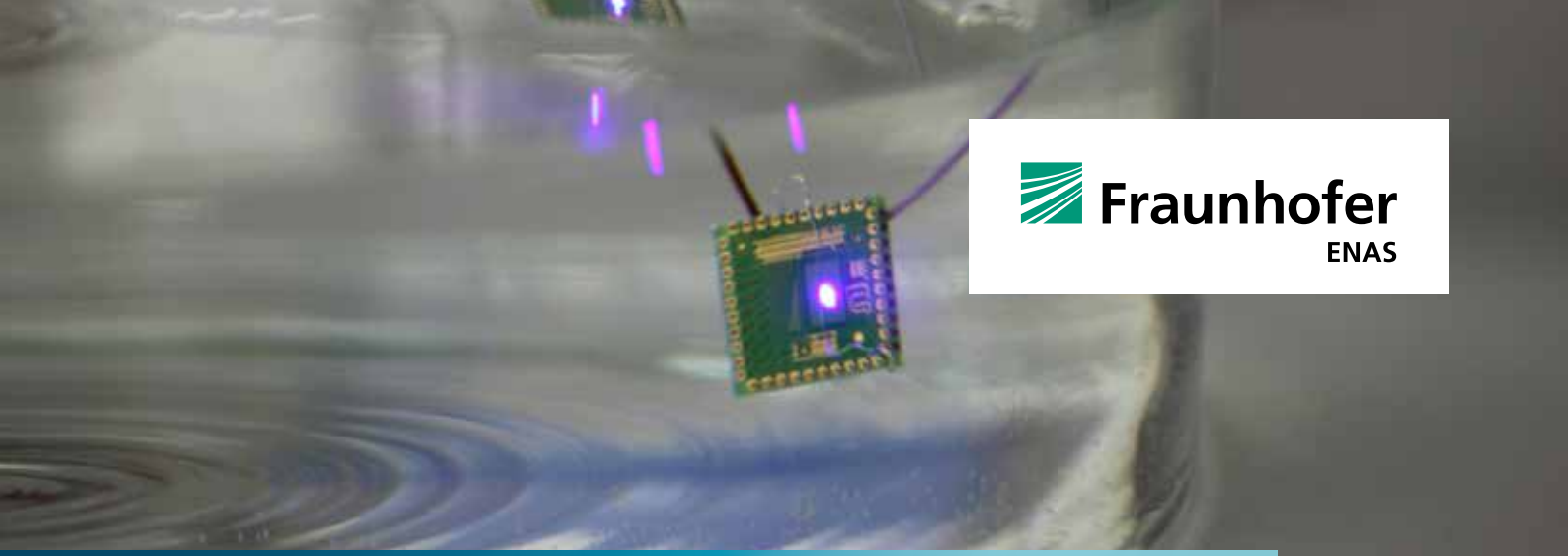

Fraunhofer ENAS

Technologies

Thin Film Encapsulation Using 3D Conformal Parylene® Deposition

Fast Facts

- Excellent moisture, chemical and dielectric barrier
- Hydrophobic
- Optical transparent
- Chemical inert
- Thermal stability
- Dry-film lubricity
- Biocompatible

General Description

T3D conform Parylene coatings are extremely thin, non porous / pinhole-free polymeric coatings for many different purposes and provide high-value surface treatment properties.

Parylene CVD Process (Gorham Process)

- Deposition at ambient temperatures
- Pinhole-free at d > 0.2 µm
- Uniform layer thickness
- Self-initiated reaction
- Un-terminated
- No solvent or catalyst required
- Yield of 100 % monomer above 550 °C in vacuum (using [2,2]p-cyclophane)
- No by-products

Parylene Deposition at Fraunhofer ENAS

- Plasma Parylene LC 300 RW
- Chamber dimensions: Ø 350 mm and 350 mm high with rotary table
- Process pressure: 2 – 5 Pa
- Plasma treatment: Ar, O_2
- Other surface treatment: Silanization (A-174)
- Facility located in clean room environment
- Deposition of Parylene C, F and other types
- Patterning by different technologies

Suggested Applications

- Electronics (dielectric coatings for circuit boards, packages for MEMS, protective coatings for organic electronics)
- Medical (biocompatible encapsulation coatings for implantable and non-implantable devices)
- Automotive (protective coatings for sensors/electronics)
- Micromechanical Systems/sensors
- Semiconductor Industry
- Analytics
- Barrier Layers (e.g. filter, membranes)
- Chemical Industry (glue, paint, gum)
- Abrasion and Corrosion Protection
- Bonding

	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]	2400	3200	2800	2500	2.500
Strain to rupture [%]	250	200	200	200	200
Yield strain [%]	2,5	2,9	3	2	2,0
Density [g/cm³]	1,11	1,289	1,418	1,32	1,32
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]	7000	5800	5500	5500	5.500
Dielectric constant @ 1 kHz	2,65	3,1	2,82	2,1	2,20
Dielectric constant @ 1 MHz	2,65	2,95	2,8	2,16	2,17
Gas permeability @ 23 °C [(cm³ x mm)/(m² x 24 h x atm)]					
N_2	7,7	0,37	1,77	4,85	4,80
O_2	11,81	2,8	12,6	23,5	23,00
H_2	212,6	43,31	94,49	n/a	n/a
H_2O [(g x mm) / (m² x 24 h)] @ 37 °C 90 %RH	0,59	0,06	0,1	0,23	0,22
Thermal expansion coefficient [ppm/°C]	69	35	38	36	36
Thermal conductivity @ 25 °C [W/(m x K)]	0,12	0,082	n/a	0,096	0,096

In cooperation with

ZfM Zentrum für Mikrotechnologien

TECHNISCHE UNIVERSITÄT CHEMNITZ

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