Introduction to Materials & Applications







PDM-500 | Aprima[®] | S700 Adhesive Paste

- Designed for use as a dispensable coating that serves as a hot-melt adhesive
- After cure, it produces no residue at 330°C, thus preventing stiction of MEMS devices
- Uses include die-attach and coating/lamination of flexible circuits and circuit boards.



Paste Properties		
Viscosity (25°C)	15,000 – 50,000 cPs	
Solvent	NMP	
Bake Conditions	120°C for 30 min 330°C for 30 min	

Film Properties	
Moisture Absorption	1.0%
Glass Transition Temperature	165°C
Ionic Impurities (Na ⁺ , NH4 ⁺ , K ⁺ , HCOO ⁻ , Cl ⁻)	< 5 ppm
Coefficient of Thermal Expansion	90 ppm/°C
Thermal Decomposition Temperature (5% weight loss)	510°C
Tensile Strength	115 MPa
Elongation (Break Point)	4%
Tensile Modulus	3.2 GPa



PDM-5004 LED & OLED Light Extraction

 Dispensable, low viscosity, solventless fluid which can thermally cure to a high strength thermoset with high refractive index (1.5-1.6) for improved light extraction







Ink-Jettable



October 2017 US 7,910,674; US 7,875,686; US 6,903,171; US 6,677,175; US 6,455,650

PDM-5007 Temporary Wafer Bonding Adhesive

Low Stress debonding successfully utilized for fragile, GaAs wafers



PDM-5010 Photopatternable Adhesive

 Spin-coatable material capable of photopatterning (solvent or TMAH develop) followed by thermocompressive bondability









PDM-5013 Aqueous Base-Develop RDL Material

 Spin-coatable, TMAHdevelopable, positivetone, photopatternable dielectric for redistribution layers (RDL)

Properties		
Dark-Field Loss	15%	
Cure loss	<10%	
Curing Condition	<200°C	
Internal Stress	10-25MPa	
Tg	220-330°C	
CTE (50-100 °C)	60-100ppm/°C	
T _{d5}	>300°C	
Tensile Modulus	2.4 GPa	
Elongation to Break	30-40%	
Tensile Strength	80-90MPa	
Adhesion to Metals	Good	
Reliability	Good	



RDL uses photopatternable dielectric materials to aid the relocation of copper wires









PDM-5019 High Aspect Ratio Patterning

 Spin-coatable, TMAH-developable, negative-tone, photopatternable dielectric for high aspect ratio applications







October 2017 SUMITOMO BAKELITE CO., LTD. US 8,986,923; Journal of Electronic Materials, 2009, 38(6), 778; Journal of Applied Polymer Science, 2011, 120(4), 1916

WD41,4mm 15.0kV x500

100.0

PDM-5022 Low Stress Patternable Material

 Spin-coatable, solvent-developable, negative-tone, photo-patternable dielectric for redistribution layers (RDL) or other applications



Properties	
Tensile strength	27 MPa
Modulus	I.2 GPa
Elongation	24 %
Τ _g	280°C
CTE	212 ppm
5% and 95% weight loss	286°C and 514°C
Dielectric constant	2.7 @ IMHz
Moisture uptake	0.1 %
Wafer warpage	I5.7 μm
Internal stress	7 MPa
Chemical Resistance	Good
Adhesion to Metals	Excellent
Straight Sidewall with 0 µm Focus	Tunable Sidewall with 30 μm Focus 5 μm

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PROM

US 8,030,425; US 8,053,515

PDM-5025 Thick Film Patternable Material

 Spin-coatable, negative-tone, polymer capable of extremely thick photopatterning and exceptional degree of planarization (DOP)



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PDM-5028 Self-Photopatternable Polymers

- Photopatternable
- Self-Crosslinking at 365nm with no PAG or sensitizer required
- Low-K
- Good adhesion to underlying and subsequent layers

Photoimaging of PNB without PAG using i-Line Stepper



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PDM-503 | Photopatternable, Dry-Etch Resist

- Spin-coatable photoresist that can be dry-etched to create air gaps
- Etch rate: 0.76 µm/min; 50/50 Ar/O₂, 300 W, 300 mtorr











PDM-5034 Air Gap Formation





PECVD Oxide Cap



Cross-Section of Air Tunnels with Oxide Overcoat Was PDM-5034

12 October 2017 SUMITOMO BAKELITE CO., LTD. Journal of Microelectromechanics and Microengineering 2006, 16, 742–750; Journal of Microelectro-mechanical Systems, 2001, 10, 400; IEEE Electron Device Letters, 2000, 21, 557

PDM-5037 Tacky Solder Flux

- Commercial "no-clean" fluxes leave residues that are difficult to remove
- No-residue flux is the technical solution to finer pitch, smaller form factor, and higher I/O density packaging where residue cleaning is not preferred

	Promerus No-Residue Flux	Commercial No-clean Flux	
Technology	Sacrificial material	"No-clean", some with rosin	
Components	All are non-halogenated	Some are halogenated	
Residue	Low to no residue	Leaves non-corrosive residue	
Residue removal	Not required	Required, but not always possible	
Residue issues	Not applicable	Joint stress, electrical leakage, dendritic growth	
Room-temp stability	>6 months	<8 hours	
Complexity	Multi-functional additives, total components <5	>20 components	
Die PDM-5037 Substrate Die Die Die Die Substrate Substrate			
► I3 October 2017			

PDM-5040 Low Optical Density Photoresist

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		PDM-5040	High O.D.	Low O.D.
 Resist thickness: PAB: Illumination: Reticle: PEB: Development: 	225nm 95°c - 60s 193 nm, NA 0.60, 2/3 Annular 6%HT 95°c - 60s NMD-3 (2.38%), 30s	Pattern profile	Poor Line Edge Com Roughness (LER)	Good LER 122mm
Target pattern:	120nm L/S	O.D. (Abs/µm)	0.33	0.25
Methacrylate Acryl ratio : 0	Hybrid Acryl ratio : 60	Acry Acryl rat	l ate tio : 100	PNB PDM-5040
500cm	Increasing PDM-5040 Conte	ent Decreases Filn	n Roughness	500mm
Rate : 55.4nm/min	Rate : 52.1nm/min	Rate : 49.	5nm/min Ra	te : 50.0nm/min
14	October 2017 Proc	SUMITON	10 BAKELITE CO., LTD. 1g., 2005 , 5753, 149; US 8,329,838	

Subsidiary of Sumitomo Bakelite Co., Ltd

PDM-5043 Photo-Alignable Layer for LCD

- Ultra-thin coatings capable of achieving alignment of liquid crystals after exposure through polarizer
- Rubbing can produce irregular scratches and defects
- PDM-5043 uses photo-alignment to remove defects and produce nanogrooves to aid alignment of LC's

Film Thickness (nm)	Polarized Exposure Dosage (J/cm ²)	Surface Anchoring Energy (J/m ²)	Pretilt Angle (deg)	LC Switching Time (msec)
20	3		<< °	40
20	4	2.2 10-5		
30	3	2.2 X 10 ⁻³		
30	4			
	rubbed	I.54 x 10⁻⁵	2-3°	40

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PDM-5046 Transparent Polymers

 Polymer films with high transparency and high T_g for flexible substrates



Properties		
Thickness	30 µm	
Refractive Index	1.52	
Birefringence	-0.003 to 0.000	
Transmissivity at 400-550 nm	90%	
CTE (at 50-150 °C)	70-150 ррт	
Decomposition temperature (95%)	350-410 °C	
T _g	190-330 °C	
Tensile Modulus	0.7-2 GPa	
Tensile Strength	20-50 MPa	
Elongation	3-50%	



PDM-5049 Top Coat for Immersion Lithography

Low OD and hydrophobic polymer with high dissolution Lens rate in TMAH developer Fluid but no dissolution of **Receding Angle** photoresist layer Non-retained Immersion Fluid Coat PR Coat TC Expose Develop Type of Defects Reduced with Use of PDM-5049 Watermarks Extra pattern Microbridging Swelling (1-0.3um) (0.3-0.1µm) (size < 0.1µm) (size > 1µm)



Contact Angle

Static

Dynamic

Sliding Angle



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PDM-5055 Thixotropic Polymer Solution



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NOUN CHEMISTRY

the property of becoming less viscous when subjected to an applied stress, shown for example by some gels that become temporarily fluid when shaken or stirred.







Useful for Solder Pastes



PDM-5058 Thin Film Pervaporation Membrane





Feed Chemical	Separation Factor	Flux (g/m²/hour) for 10um thick	Feed Concentration
n-Butanol	70	1200	5%
lsobutanol	35	1070	5%
Propanol	9.7	470	5%
Ethonal	5.4	250	5%
Ethanoi	3.4	440	10%
Ethyl Acetate	90	1780	5%
Methyl Ethyl Ketone	51	1960	5%
Tetrahydrofuran	48	940	5%



PDM-5061 Low Loss at High Frequency

 Solvent-less system that is thermally catalyzed within a mold to produce a flame-resistant part (V-0) having low signal loss at high frequencies

	FR-4	PTFE	PDM- 5061
3	4.72	2.29	2.28
Tan δ (RT; 50 GHz)	0.0849	0.0017	0.0004
Z ₀	50Ω	50Ω	50Ω
Thickness	0.26 mm	0.38 mm	0.30 mm



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US Publication 2016/0289371



PDM-5064 Functionalized Norbornenes

Functionalized norbornenes contain a variety of reactive and non-reactive groups. Common substituents include:

- Acetate [-OC(O)R]
- Ester [-CO₂R]
- Alcohol [-OH]
- Ether [-OR]
- Amine [-CH₂NH₂]
- Alkyl [-R]
- Ketone [-C(O)R]
- Anhydride [-RC(O)O(O)CR]
- Silyl Ether [-Si(OR)₃]
- Epoxide [-CH₂CH(O)CH₂]
- Phenyl [-Ar]
- Vinyl [-CH=CH₂]

- Isomer Ratio Typically ~ 80:20 Endo/Exo
- Single Isomer Versions Possible For Certain Monomers



endo isomer



exo isomer

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PDM-5067 Architecture-Controlled Polymer



October 2017

SUMITOMO BAKELITE CO., LTD US 9.415.354

PDM-5070 Moldable Polynorbornene





Moldable PNB Properties		
T _g (DMA)/°C	221	
Td₅/°C	363	
G'/MPa	1200	
G"/MPa	70	
Tensile strength/MPa	13	
Tensile modulus/MPa	343	
Elongation %	24	



October 2017

Summary

• We are here to help you with your custom synthetic needs in monomer, polymer, or application development







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