## MOMENTIVE

Silicone Material Solutions for LED Packages and Assemblies



## LED Packaging and Assembly Solutions from Momentive Performance Materials

The growth of optoelectronic devices and LEDs in segments such as handheld devices, mobile phones, display backlights, automotive, and electronic signs, has led to an increase in demand for enhanced performance and long-term reliability. Designers of LEDs and optoelectronic devices will find a range of silicone material solutions from Momentive, that are excellent candidates to address a wide array of challenges facing the LED industry.

#### InvisiSil\* LED Encapsulants

Momentive's InvisiSil series of silicone encapsulants exhibit unique optical efficiencies and a high-refractive index, while providing long-term resistance against the yellowing and delamination typical of conventional epoxy-based materials. (p.4-5)

#### Silicones for LED Die Attach

Momentive's die attach silicones offer a high heat and UV resistant alternative to conventional epoxy based die attach materials. These silicone materials are characterized by minimal yellowing, and contribute to long-term stability of light output. (p.8)

#### Silicone Lens Materials

or optical lens fabrication Momentive ffers a series of products engineered to rovide high transparency and mechanical trength. These moldable silicone naterials are excellent candidates for jection molding systems that maximize be benefits of LIM processing. (p.7)

#### Glob Top Encapsulants

Momentive's Glob Top encapsulants exhibit good light transmittance, and are formulated to provide consistent dispensing performance and material flow to form a dome shape. Component designers with chip-mounting and wirebonding capabilities can benefit from the process simplicity that these materials offer in LED Glob Top packaging applications. (p.6)

#### Dot Matrix and LED Assembly Materials

LED dot matrix potting materials are available in room temperature and heataccelerated alternatives. The low viscosities of these potting materials make them great materials of choice for potting applications in intricate Dot Matrix applications and LED Assemblies. (p.9)

#### Silicone Advantages



#### Performance Comparison

	Silicone	Ероху
hermal Resistance	Excellent	Fair
IV Resistance	Excellent	Poor
lardness	Good	Excellent
dhesion Strength	Good	Excellent
hermal Expansion	Fair	Good
Ioisture Absorption	Good	Fair
loisture Permeability	Fair	Good

The chemical structure of silicone provides several advantages over conventional materials used in optoelectronic applications. The backbone structure of polydimethylsiloxane consists of silicon (Si) and oxygen (O). The siloxane bond (Si-O) is inorganic and has a higher bond energy of (444kJ/mol) than either carbon (C) - carbon (C) bond (356kJ/mol), or carbon (C) - oxygen (O) bond (339kJ/mol). This bond energy difference is ascribed as one of the contributing factors to the better thermal stability of silicone over that of epoxy resin. The inorganic siloxane bond of silicone materials and its resultant bond energy, contributes to stable performance under harsh operating conditions. This is manifest in performance advantages to epoxy resins under some usage conditions.



#### InvisiSil\* LED Encapsulants

InvisiSil series, silicone encapsulants deliver high refractive index & light transmittance to effectively transmit light emitted from LEDs. They help contribute to durability and reliability of devices through their long-term resistance to yellowing and delamination of encapsulant from the substrate. They also provide low viscosities that make them candidates for a wide variety of LED packages such as small SMD packages, larger power packages, and multi-chip COB packages.



0 10 20 30 40 50 60 70 80 90 Hardness (Type A)

#### **Kev Features**

- Selection from a range of refractive index
- up to 1.53 (n<sub>D</sub><sup>25</sup>)
- High light transmittance (>98%, 400-800nm)
- Good workability
- High purity
- Adhesion to PPA, LCP

Product Det	ndex				
			XE14-C2860	XE14-C3450	IVS5854
Components		2 Part	2 Part	2 Part	
Cure Type			Heat Cure	Heat Cure	Heat Cure
Property			Gel	Rubber	Resin
Viccocity	(A)	Pa∙s	0.9	6.7	8.1
VISCOSILY	(B)	Pa∙s	0.6	2.2	4.3
Mixing Ratio	(A:B)		100:100	20:100	10:100
Viscosity (mixed) @23°C		Pa∙s	0.8	2.5	4.5
Refractive Inde	ЭX	n <sub>D</sub> <sup>25</sup>	1.51	1.53	1.53
Curing Conditi	on	°C/h	80/1	150/1 <sup>1</sup>	150/1 <sup>2</sup>
Transmittance (1mm: 400nm, 800nm) %		m) %	98, >99 98, >99		98, >99
Penetration			35	-	-
Hardness (Typ	e A)		-	29	46 (Type D)
Specific Gravit	y @23	3°C	-	1.11	1.18
Adhesion Strength MPa		-	0.2	1.9	
CTE		1/K	-	2.6 x 10 <sup>-4</sup> 1.0 x 2.2 x	

Packaging: XE14-C2860 A & B 500g bottles. XE14-C3450 A 100g, B 500g bottles. IVS4854 A 50g, B 500g bottles. 1 Step cure (90min@80°C, 1h@150°C) recommended for package dispensing applications. <sup>2</sup> Step cure (2h@100°C, 1h@150°C) recommended for package dispensing applications. Typical property values should not be used as specifications

			Normal Refractive Index							
		IVS4312	XE14-C2042	IVS4542	IVS4546	IVS4622	IVS4632	IVS4742	IVS4752	
Components		2 Part	2 Part	2 Part	2 Part	2 Part	2 Part	2 Part	2 Part	
Cure Type		Heat Cure	Heat Cure	Heat Cure	Heat Cure	Heat Cure	Heat Cure	Heat Cure	Heat Cure	
Property		Rubber	Rubber	Rubber	Rubber	Rubber	Rubber	Rubber	Rubber	
Viccosity	(A) Pa·s	1.2	6.2	5.7	6.1	4.2	7.5	14	7.0	
VISCOSILY	(B) Pa·s	0.8	4.4	3.2	3.3	1.5	1.4	2.4	4.0	
Mixing Ratio	(A:B)	100:100	100:100	100:100	100:100	100:100	100:100	100:100	100:100	
Viscosity (mixed)	@23°C Pa·s	1.0	4.9	3.8	4.2	2.4	3.2	4.2	5.0	
Refractive Index	n <sub>D</sub> <sup>25</sup>	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	
<b>Curing Condition</b>	°C/h	150/11	150/11	150/1 <sup>1</sup>	150/1 <sup>1</sup>					
Transmittance (1mm: 400nm, 80	)0nm)%	>99, >99	>99, >99	>99, >99	>99, >99	>99, >99	>99, >99	>99, >99	>99, >99	
Hardness (Type /	A)	29	43	48	49	55	64	71	72	
Tensile Strength	MPa	0.8	6.0	6.6	7.1	7.2	9.0	11	4.6	
Elongation	%	110	170	110	130	100	80	70	90	
Specific Gravity @	@23°C	0.99	1.02	1.03	1.03	1.04	1.05	1.05	1.05	
Adhesion Strength	n (PPA) MPa	0.3	3.0	3.7	3.2	3.2	1.5	2.7	3.1	
CTE	1/K	3.3 x 10 <sup>-4</sup>	2.8 x 10-4	2.8 x 10 <sup>-4</sup>	2.7 x 10 <sup>-4</sup>	2.7 x 10-4				

Packaging: 500g Bottles <sup>1</sup> Step cure (90min@80°C, 1-2 h@150°C) recommended for package dispensing applications Typical property values should not be used as specifications

#### **InvisiSil Series** Transmittance

#### **Thermal Stability**

InvisiSil LED Encapsulants help contribute to long-term thermal stability of LEDs. This is represented in thermal stability tests conducted using IVS4542 and LED grade epoxy resins. Tests were performed by exposing both materials, sandwiched between glass plates, to 180°C temperatures. While the transmittance of IVS4542 remained stable under prolonged periods of heat exposure, epoxy resins demonstrated deterioration in transmittance over time accompanied by yellowing of the encapsulant material.

**UV Stability** 







Transparency Performance<sup>1</sup>





Test Conditions: IVS4542 and epoxy resin cured in glass sandwich specimens and exposed to 180°C temperatures for specified time intervals

Test Conditions: IVS4542 and epoxy resin cured in glass sandwich specimens and exposed to UV lamp: Black light, 100mJ/cm²/min at 365nm detector

ransmittance	
0 600 650 700 750 800 th (nm)	

### Product Details

#### **Glob Top Encapsulants**

Momentive's Glob Top encapsulants exhibit good light transmittance, and are excellent candidates to provide consistent dispensing performance and material flow to form a dome shape for COB (chip on board) encapsulation. Component designers with chip-mounting and wire-bonding capabilities can benefit from the process simplicity that these materials offer in LED COB packaging applications.

		XE14-B3445	XE14-B5778	XE13-C0810
Components		2 Part	2 Part	1 Part
Cure Type		Heat Cure	Heat Cure	Heat Cure
Property		Rubber	Rubber	Gel
Appearance		Translucent	Translucent	Translucent
Viceocity (A)	Pa⋅s	70	5.5	-
VISCOSITY (B)	Pa⋅s	55	5.0	-
Mixing Ratio (A:B)		100:100	100:100	-
Viscosity (mixed) @23°C	Pa⋅s	63	14	14
Pot Life @23°C	h	72	8	-
Refractive Index	n <sub>D</sub> <sup>25</sup>	1.41	1.41	1.41
Curing Condition	°C/h	150/1	80/2	150/1
Transmittance (1mm: 40	0nm, 800nm) %	69, 86	79, 92	69, 85
Hardness (Type A)		70	16	24
Specific Gravity @23°C		1.10	1.02	1.02
Tensile Strength	MPa	-	0.5	-
Elongation	%	-	190	170
Adhesion Strength (Al)	MPa	3.5	0.3	0.6
Thermal Conductivity	W/m·K	0.20	0.17	0.18
CTE	1/K	2.7 x 10-4	2.3 x 10 <sup>-4</sup>	3.0 x 10 <sup>-4</sup>
Volume Resistivity	MΩ·m	1 x 10 <sup>7</sup>	2 x 10 <sup>5</sup>	2 x 10 <sup>7</sup>
Dielectric Strength	kV/mm	24	24	21
Dielectric Constant (60H	IZ)	2.8	2.7	2.6
Dielectric Loss (60Hz)		0.001	0.001	0.003
Ionic Content (Na, K, Cl	l) ppm	<2, <2, <5	<2, <2, <5	<2, <2, <5

#### Lens Fabrication Materials

For optical lens fabrication Momentive offers a series of products engineered to provide high transparency and mechanical strength. These moldable silicone materials are excellent candidates for injection molding systems that maximize the benefits of LIM processing.

Product Details			
		IVSM4500	XE14-C25081
Components		2 Part	2 Part
Cure Type		Heat Cure	Heat Cure
Property		Resin	Resin
ppearance		Transparent	Transparent
(iccocity)	A) Pa·s	300	90
(	B) Pa·s	50	500
/lixing Ratio (A	A:B)	100:100	100:10
iscosity (mixed) @23	°C Pa·s	30	100
Pot Life @23°C	h	24	24
Curing Condition	°C/h	150/1	180/1
Refractive Index	n <sub>D</sub> <sup>25</sup>	1.42	1.53
ransmittance (1mm: 4	400nm, 800nm) %	93.9, 94.6	87.8, 91.3
lardness (Type A)		50	68
oung's Modulus	MPa	80	-
ensile Strength	MPa	4.7	-
longation	%	<5	-
TE	1/K	2.2 x 10-4	-
Shrinkage	%	2.5	-

Packaging: 1kg can, 18kg pail <sup>1</sup> Experimental grade Typical property values should not be used as specifications.

Packaging: 500g Bottles

Typical property values should not be used as specifications



**Die Attach Silicones** 

Momentive's die attach silicones offer a high heat and UV resistant alternative to conventional epoxy based die attach materials. These silicone materials are characterized by minimal yellowing, and contribute to long-term stability of light output.

Product Details		
		XE13-C2476
Characteristic		Electro-Insulative
Components		1 Part
Cure Type		Heat Cure
Property		Rubber
Appearance		Translucent
Viscosity @23°C	Pa⋅s	30
Curing Condition	°C/h	150/1
Thermal Conductivity	W/m·K	0.20
Specific Gravity @ 23°C		1.15
Hardness		58 (Type D)
Adhesive Strength (Al)	kV/mm	3.0
Volume Resistivity	MΩ·m	1.0x10 <sup>7</sup>
Refractive Index	(n <sub>D</sub> <sup>25</sup> )	1.42
Ionic Content (Na, K, Cl)	ppm	<2, <2, <5

Packaging: 10ml Syringe

Typical property values should not be used as specifications

#### **Dot Matrix and** Assembly Materials

LED dot matrix potting materials are available in room temperature and heataccelerated alternatives. The low viscosities of these potting materials make them excellent materials of choice for intricate Dot Matrix applications and LED Assemblies for a variety of industries ranging from signage, automotive, to lighting. These silicone materials provide enchanced weatherablility performance, especially in locations with high salt air concentrations, and represent a smart alternative to conventional epoxy or urethane materials.

<b>Product Details</b>		Dot Matrix	Materials	LED Assembly Materials			
		XE12-B2543	XE14-C0447	TSE3032	TSE3033	RTV615	
Components		2 Part	2 Part	2 Part	2 Part	2 Part	
Cure Type		Room Temp.	Heat Cure	Heat Cure	Heat Cure	Heat Cure	
Property		Rubber	Rubber	Rubber	Rubber	Rubber	
Appearance		Translucent	Translucent	Translucent	Translucent	Translucent	
Viscosity @22°0	(A) Pa·s	1.8	1.9	4.2	1.1	4.3	
VISCOSILY @23 C	(B) Pa·s	-	1.7	0.7	0.8	-	
Mixing Ratio	(A:B)	100:2	100:100	100:10	100:100	100:10	
Viscosity (mixed) @ 23°C	Pa∙s	-	1.7	4.0	0.9	4.0	
Pot Llfe @ 23°C		2	2	4	6	4	
Curing Condition	°C/h	23/72	80/1	100/1	150/0.5	100/1	
Specific Gravity @	23°C	1.11	0.99	1.02	1.01	1.02	
Hardness (Type A)		28	15 (Type E)	35	30	44	
Tensile Strength	MPa	0.8	-	4.5	1.0	6.3	
Elongation	%	130	-	210	130	120	
Adhesion Strength	n MPa	0.42 (Al)	adhesive	-	0.3 (glass)	-	

Typical property values should not be used as specifications

Packaging									
	30g bottle	100g bottle	1lb (454g)	500g bottle	1kg can	10 lb (4.5kg)	15 kg pail	18kg pail	44lb (22kg)
XE12-B2543 (A)					٠			٠	
XE12-B2543 (B)	•			•					
XE14-C0447 (A)							٠		
XE14-C0447 (B)							•		
TSE3032 (A)					•		•		
TSE3032 (B)		٠		•			٠		
TSE3033 (A)					•			•	
TSE3033 (B)					•			•	
RTV615 (A:B Kit)			٠			٠			•



Product Availability by Region <sup>1</sup>							
	Japan	Korea	China	US	Europe		
XE14-C2860	•		•	•	•		
XE14-C3450	•	•	•		•		
IVS5854	•	•	•		•		
IVS4312	•	•	•	•	•		
XE14-C2042	•	•	•		•		
IVS4542	•	•	•	•	•		
IVS4546	•	•	•		•		
IVS4622	•	•	•		•		
IVS4632	•	•	•	•	•		
IVS4742	•	•	•		•		
IVS4752	•	•	•		•		
XE14-B3445	•	•	•	•	•		
XE14-B5778	•	•	•	•	•		
XE13-C0810	•		•	•	•		
IVSM4500	•	•	•	•	•		
XE14-C2508	•						
XE13-C2476	•						
XE12-B2543	•						
XE14-C0447	•	•	•	•			
TSE3032	•	•	•	•	•		
TSE3033	•	•	•	•	•		
RTV615	•	•	•	•	•		

<sup>1</sup> Contact a Momentive Performance Materials sales representative for availability in countries and regions not listed

### Other Electronic Solutions from Momentive Performance Materials

12-page brochure provides detailed information on silicone materials used for thermal management applications in electronics and micro-electronics. Includes SilCool\* grease & adhesives, and conventional grades for adhesion, encapsulation and potting.



# Product Availability

Comprehensive package of adhesion, sealing, coating, and encapsulation / potting solutions for a wide range of silicone applications in electric and electronic devices and component assemblies.

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