

UV-Curable Composit for Micro Optical Elements

Products

	NL-S1010	NL-S1030	NL-AB1030	NL-AL2030
Features	High Tg High heat resistance Solvent free	Solvent free Low Viscosity Heat resistance	nD1.51	nD1.60 Non filler High RI
Applications	DOE MLA WLO	Dilluent for NL-S1010	MLA WLO DOE	MLA WLO DOE

Properties before UV-curing

Viscosity (25°C/77°F) [mPa·s]	1800-2600	18	700-800	1800-2200
Exposure dose @365nm ^{*1} [mJ/cm ²]	50-200	100-300	1000-3000	3000

Properties after UV-curing

Glass transition temperature (DMA, °C)	220	160	145	130
Curing Shrinkage [%]	8	11	6	4
RI (25°C/77°F)	486nm (F)	1.520	1.516	1.523
	589nm (D)	1.513	1.501	1.510
	656nm (C)	1.511	1.499	1.506
Abbe number at 25°C/77°F (V _D)	57	29	30	29

❖ We can customize and meet your required property.

Note: Numerical data in the table are typical and any guarantee is not provided.

NL-S1010

Applications

- ❖ Nano imprint Lithography
- ❖ MLA
- ❖ DOE
- ❖ WLO
- ❖ Lens and prism bonding

Features

- ❖ Solvent free
- ❖ Spin coat-able
- ❖ Suitable for making optical elements with nanoimprint lithography
- ❖ Suitable for solder reflow post process
- ❖ High T_g, high heat resistance (Solder heat resistance 300°C/572°F 3min. 3times), excellent durability
- ❖ High transmittance and good transparency

Typical Properties

Uncured resin

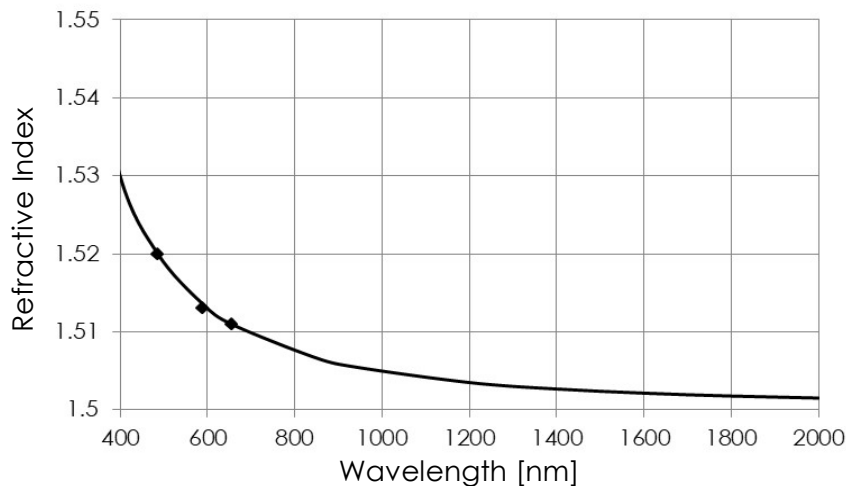
Viscosity at 25 °C, mPa.s or cps	1800 to 2600
Solvent free	Yes
Density (g/mL)	1.13
Exposure dose @365nm* ¹ [mJ/cm ²]	50 to 200

Cured film

Appearance of cured adhesive	optically clear
Shrinkage* ² (linear, %)	8
Hardness – Shore D	90
Glass transition temperature (DMA, °C)	220
Refractive index of cured film (25 °C)	@ 486 nm (F) 1.520 @ 589 nm (D) 1.513 @ 656 nm (C) 1.511
Abbe Number at 25 °C (V _D)	58

NK OPTIMER[®] NL series

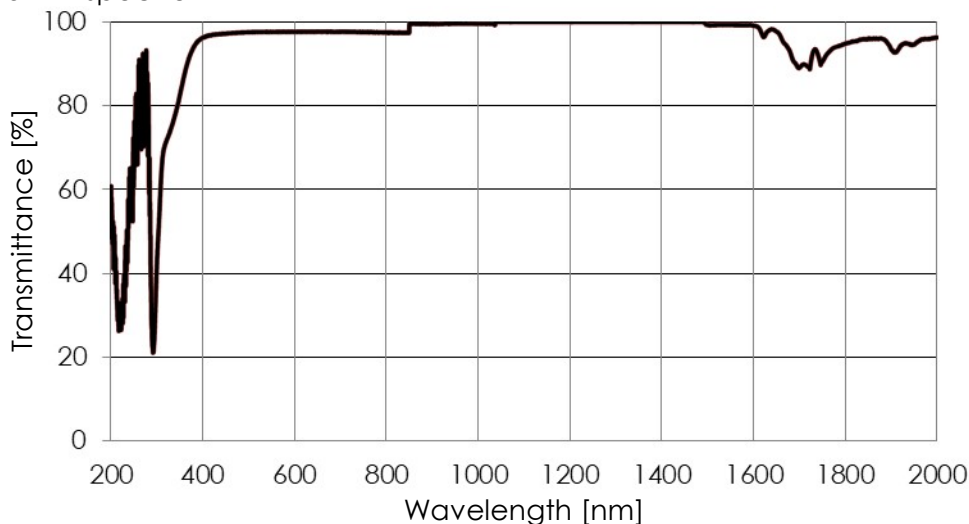
Sellmeier equation



$$n(\lambda) = \sqrt{1 + \frac{A\lambda^2}{\lambda^2 - B}}$$

$$A=1.2512, B=0.0107, \lambda [\mu m]$$

UV-Vis and NIR spectrum



Pencil Hardness

H

Bend test (cylindrical mandrel)

<2mm

Heat resistance^{※3}

Initial Value	Tt [%]	>90	After 3min x 3 300°C/572°F	ΔTt [%]	<1
	Haze	<1		Δhaze	<1
	YI	3.0		ΔYI	<1

Heating loss (300°C/572°F, 1 hr)

<-2%

※1 Irradiate 1mm thick sample with UV-LED (365nm) 5mW/cm² and checked by finger

※2 Irradiate 1mm thick sample with 5times UV-LED (365nm) 1 pass 5mW/cm² 100mJ/cm² and measure the cured compound

※3 Measure 5 pass 1mm thick

◆ We can customize and meet your required property.

Note: Numerical data in the table are typical and any guarantee is not provided.

3 / 10

Wakayama : TEL +81-73(423)3256 Tokyo sales office : TEL+81- 3(3256)2671

Osaka sales office : TEL+81- 6(6533)0395 Shanghai : TEL +86-21-6235-1811

<https://www.shin-nakamura.com/>

CopyRight©2023 Shin-Nakamura Chemical Co., Ltd. All Right Reserved



ありがとうを化学する

新中村化学工業株式会社
Shin-Nakamura Chemical Co., Ltd.

2023.05.30

NL-S1030

(Heat resistant diluent for NL-S1010)

Applications

- ❖ Nano imprint Lithography
- ❖ MLA
- ❖ DOE
- ❖ WLO
- ❖ Lens and prism bonding

Features

- ❖ Solvent free
- ❖ Low Viscosity
- ❖ Spin coat-able
- ❖ Suitable for making optical elements with nanoimprint lithography
- ❖ High Tg, high heat resistance (Solder heat resistance 300°C/572°F 3min. 3times), excellent durability
- ❖ High transmittance and good transparency

Typical Properties

Uncured resin

Viscosity at 25 °C, mPa.s or cps	18
Solvent free	Yes
Density (g/mL)	1.08
Exposure dose @365nm*1 [mJ/cm ²]	100 to 300

Cured film

Appearance of cured adhesive	optically clear
Shrinkage*2 (linear, %)	11
Hardness – Shore D	90
Refractive index of cured film (25 °C)	@ 486 nm (F) 1.516 @ 589 nm (D) 1.501 @ 656 nm (C) 1.499
Abbe Number at 25 °C (V _D)	29

Pencil Hardness	HB
Bend test (cylindrical mandrel)	<2mm
Heat resistance*3	

Initial Value	Tt [%]	>90	After 3min x 3 300°C/572°F	ΔTt [%]	<1
	Haze	<1		Δhaze	<1
	YI	3.0		ΔYI	<1
Heating loss (300°C/572°F, 1hr)			<-6%		

- ※1 Irradiate 1mm thick sample with UV-LED (365nm) 5mW/cm² and checked by finger
- ※2 Irradiate 1mm thick sample with 5times UV-LED (365nm) 1pass 5mW/cm² 100mJ/cm² and measure the cured compound
- ※3 Measure 5 pass 1mm thick

❖ We can customize and meet your required property.

Note: Numerical data in the table are typical and any guarantee is not provided.



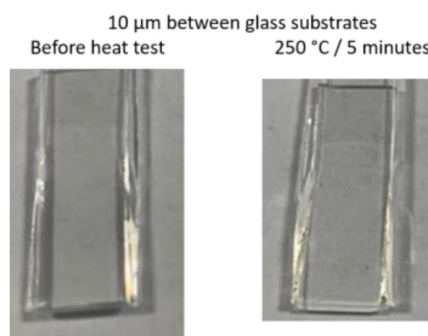
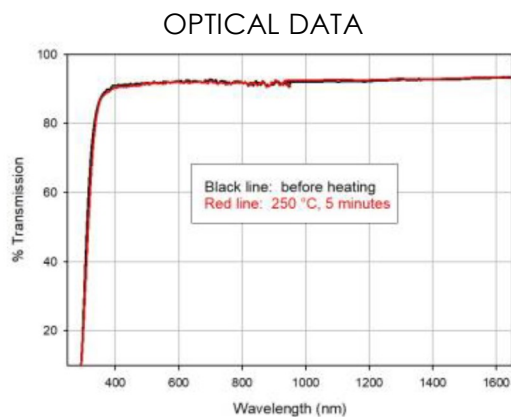
NL-AB1030

Applications

- ❖ Nano imprint Lithography
- ❖ MLA
- ❖ DOE
- ❖ WLO
- ❖ Lens and prism bonding

Features

- ❖ High T_g, robust reliability performances, high heat resistance, good flow properties, excellent adhesion, high hardness.



high heat resistance, non-yellow

Typical Properties

Uncured resin

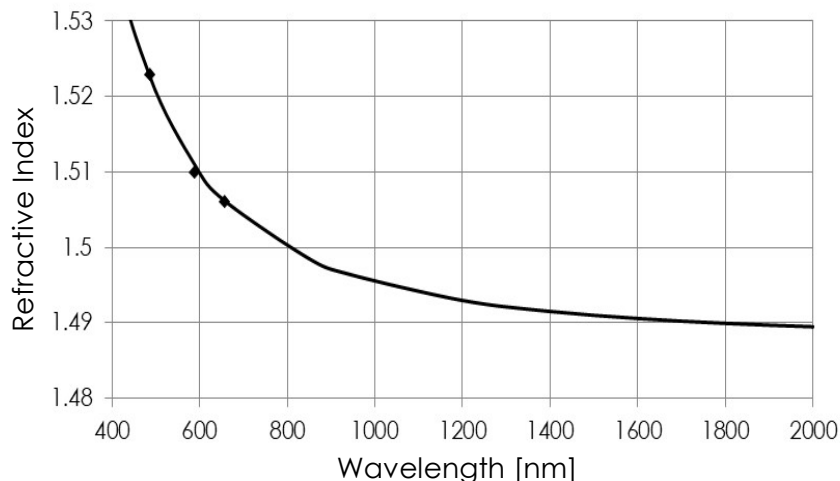
Viscosity at 25 °C, mPa.s or cps	700 to 800
Solvent free	Yes
Density (g/mL)	1.1
Exposure dose @365nm [mJ/cm ²]	1000 to 3000

Cured film

Appearance of cured adhesive	optically clear
Shrinkage (linear, %)	6
Hardness – Shore D	90
Glass transition temperature (DMA, °C)	145
Refractive index of cured film (25 °C)	@ 486 nm (F) 1.523 @ 589 nm (D) 1.510 @ 656 nm (C) 1.506
Abbe Number at 25 °C (V _D)	30

NK OPTIMER® NL series

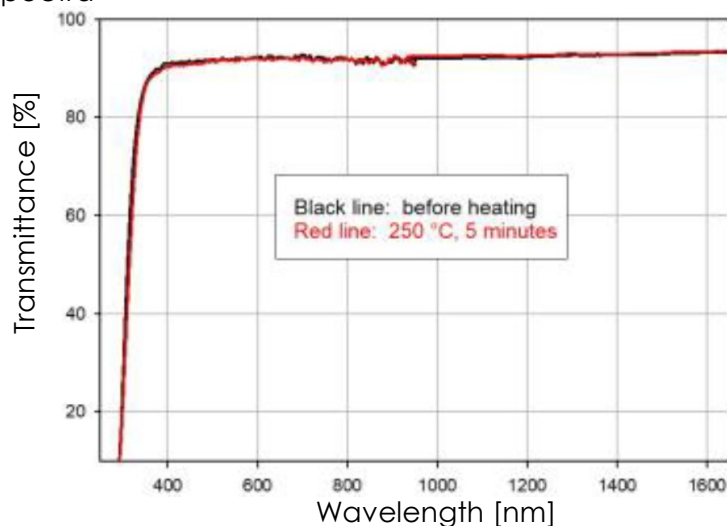
Sellmeier equation



$$n(\lambda) = \sqrt{1 + \frac{A\lambda^2}{\lambda^2 - B}}$$

$A=1.2127, B=0.0190, \lambda [\mu m]$

UV-Vis and NIR spectra



Layer thickness	5 to 100 μm
Coefficient of thermal expansion (ASTM E831)	
below T _g ($\times 10^{-6}$), $^{\circ}C^{-1}$	59
above T _g ($\times 10^{-6}$), $^{\circ}C^{-1}$	141
Physical properties tested at 25 $^{\circ}C$, 50% RH (ASTM D638)	
Tensile strength, MPa	63
Elongation (%)	6
Young's Modulus, MPa	2000
Operating temperature, $^{\circ}C$	-40 to 150

❖ We can customize and meet your required property.

Note: Numerical data in the table are typical and any guarantee is not provided.

6 / 10

Wakayama : TEL +81-73(423)3256 Tokyo sales office : TEL+81- 3(3256)2671
 Osaka sales office : TEL+81- 6(6533)0395 Shanghai : TEL +86-21-6235-1811
<https://www.shin-nakamura.com/>
 CopyRight©2023 Shin-Nakamura Chemical Co., Ltd. All Right Reserved



ありがとうを化学する
 新中村化学工業株式会社
 Shin-Nakamura Chemical Co.,Ltd.

2023.05.30

NL-AL2030

Applications

- ❖ Nano imprint Lithography
- ❖ MLA
- ❖ DOE
- ❖ WLO
- ❖ Lens and prism bonding

Features

- ❖ High Tg, high refractive index, good flow properties, high heat stability and high hardness

Typical Properties

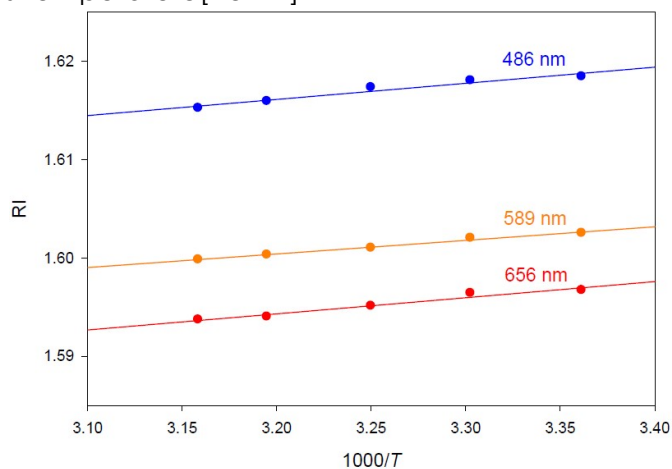
Uncured resin

Viscosity at 25 °C, mPa.s or cps	1800 to 2200
Solvent free	Yes
Density (g/mL)	1.1
Exposure dose @365nm [mJ/cm ²]	2000 or more

Cured film

Appearance of cured adhesive	optically clear
Shrinkage (linear, %)	4
Hardness – Shore D	95
Glass transition temperature (DMA, °C)	130
Refractive index of cured film (25 °C)	@ 486 nm (F) 1.618 @ 589 nm (D) 1.602 @ 656 nm (C) 1.597

Refractive index vs temperature[Kelvin]

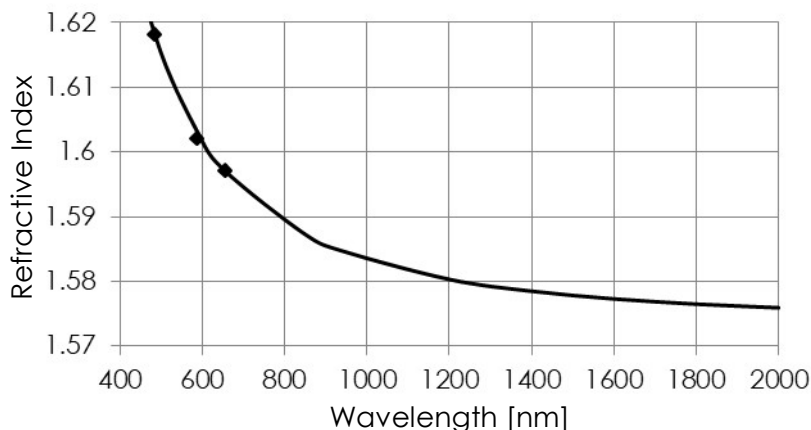


Abbe Number at 25 °C (V_D)

27

NK OPTIMER[®] NL series

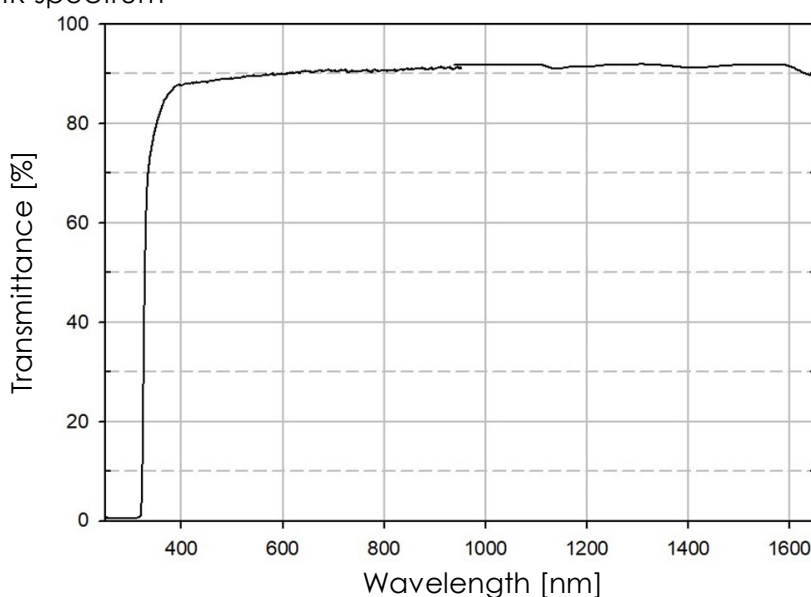
Sellmeier equation



$$n(\lambda) = \sqrt{1 + \frac{A\lambda^2}{\lambda^2 - B}}$$

$A=1.4758, B=0.0207, \lambda [\mu m]$

UV-Vis and NIR spectrum



Depth of cure	>5 mm
Coefficient of thermal expansion (DMA)	
below Tg (x10 ⁻⁶), °C ⁻¹	35
above Tg (x10 ⁻⁶), °C ⁻¹	175
Physical properties tested at 25°C, 50% RH (ASTM D638)	
Elongation (%)	18
Young's Modulus, MPa	1380
Operating temperature, °C	-40 to 140

❖ We can customize and meet your required property.

Note: Numerical data in the table are typical and any guarantee is not provided.



NK OPTIMER[®] NL series

Nanoimprintable

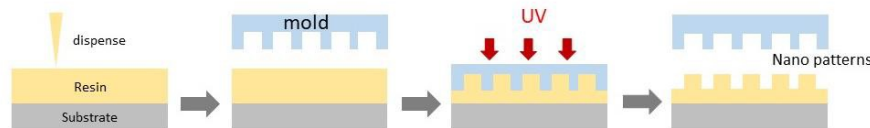
High Refractive Index UV-Curable Composite

NL-N series

Adjustable refractive index based on various wavelength

Applications

❖ Nano imprint Lithography



❖ AR/MR waveguides ❖ Displays ❖ Sensors ❖ DOE

Features

- ❖ Suitable for making optical elements with nanoimprint lithography
- ❖ Quick cure
- ❖ High transmittance and good transparency
- ❖ Spin coat-able

Products

	NL-N6245NF	NL-N6345	NL-N7132	NL-N80X	NL-N84X	NL-N93X	
Properties before UV-curing							
NV	~50	~30	~35	~30	~30	~20	
Contains filler		✓	✓	✓	✓	✓	
Exposure dose @365nm ^{※1} [mJ/cm ²]	100-300	100-300	100-300	100-300	100-300	100-300	
Properties after UV-curing							
Curing Shrinkage [%]	1	2	5	3	2	3	
RI (25°C/77°F)	588nm (d)	1.615	1.631 ^{※2}	1.710 ^{※2}	1.800	1.844	1.926
	623nm	1.612	1.627	1.705			
	839nm	1.600	1.616	1.691			
	1300nm	1.590	1.607	1.676			
	1550nm	1.587	1.605	1.673			
Abbe number at 25°C/77°F (V _d) ^{※2}	45	45	32				
Total Transmittance (JISK7361-1)(360-830nm)							
Haze (JISK7361)							
85°C 85%RH [hours]							

※1 365nm UV-LED in nitrogen

※2 Calculated value by Cauchy equation

$$n(\lambda) = A + \frac{B}{\lambda^2} + \frac{C}{\lambda^4} + \frac{D}{\lambda^6} + \dots$$

❖ We can customize and meet your required property.

Note: Numerical data in the table are typical and any guarantee is not provided.

9 / 10

Wakayama : TEL +81-73(423)3256 Tokyo sales office : TEL+81- 3(3256)2671

Osaka sales office : TEL+81- 6(6533)0395 Shanghai : TEL +86-21-6235-1811

<https://www.shin-nakamura.com/>

CopyRight©2023 Shin-Nakamura Chemical Co., Ltd. All Right Reserved



ありがとうを化学する

新中村化学工業株式会社
Shin-Nakamura Chemical Co.,Ltd.

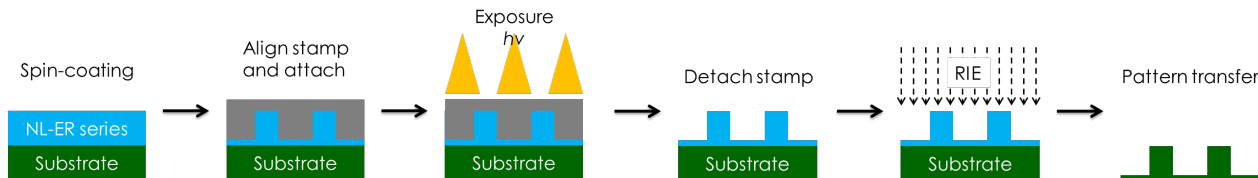
2023.05.30

Resists for UV-NIL (via RIE)

NL-R series

Applications

- ❖ Nano imprint Lithography process scheme



Features

- ❖ Primer free
- ❖ Spin coat-able. Excellent performance at film thickness uniformity. Easy to form a thin film which has a good uniformity in thickness at spin-coating.
- ❖ Decompression resistance. Hard to volatilize at decompression defoaming process (thin film on the wafer).
- ❖ Baking resistance. Hard to volatilize at hot-air drying process (thin film on the wafer)

Typical Properties (NL-R1020)

Uncured resin

NV [%]	50
Viscosity at 25 °C, mPa.s or cps	390
Density [g/mL]	1.029
Exposure dose @365nm ^{*1} [mJ/cm ²]	50 to 200

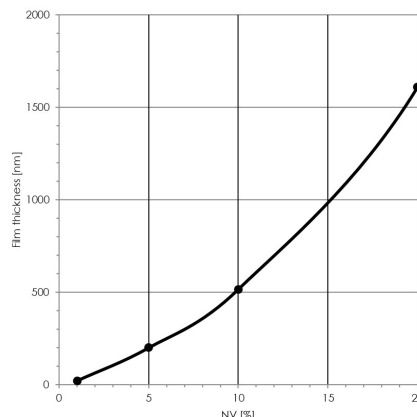
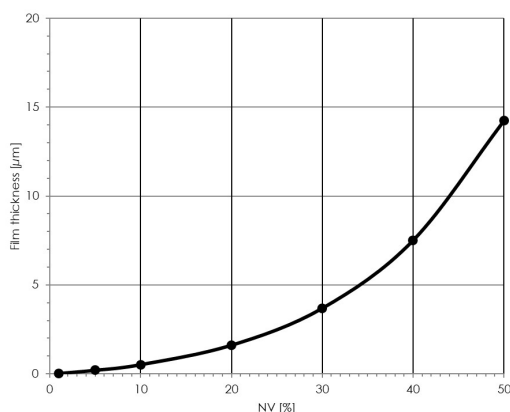
Cured film

Appearance of cured adhesive	optically clear
Shrinkage ^{*2} [%]	3
Ohnishi parameter	2.68

^{*1} Irradiate 1000nm thick sample with UV-LED (365nm) 5mW/cm² and checked by finger

^{*2} Irradiate 1000nm thick sample with 5times UV-LED (365nm) 1pass 5mW/cm² 100mJ/cm² and measure the cured compound

NV-Thickness curve



Coating condition: Spin-coating 1000rpm on 4" silicon wafer
Diluent: PGMEA

- ❖ We can customize and meet your required property.

Note: Numerical data in the table are typical and any guarantee is not provided.