kaneka

The Dreamology Company

—Make your dreams come true—

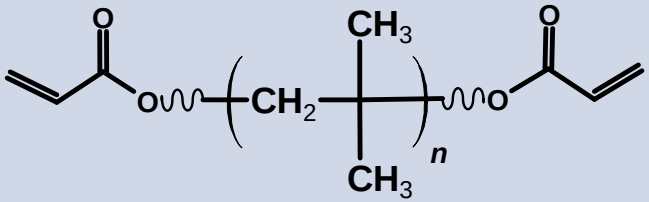
KANEKA EPION™ EP400V

UV-Curable Polyisobutylene liquid polymer

KANEKA CORPORATION

Jan. 2022

Curable Polyisobutylene (KANEKA EPION™ EP400V)

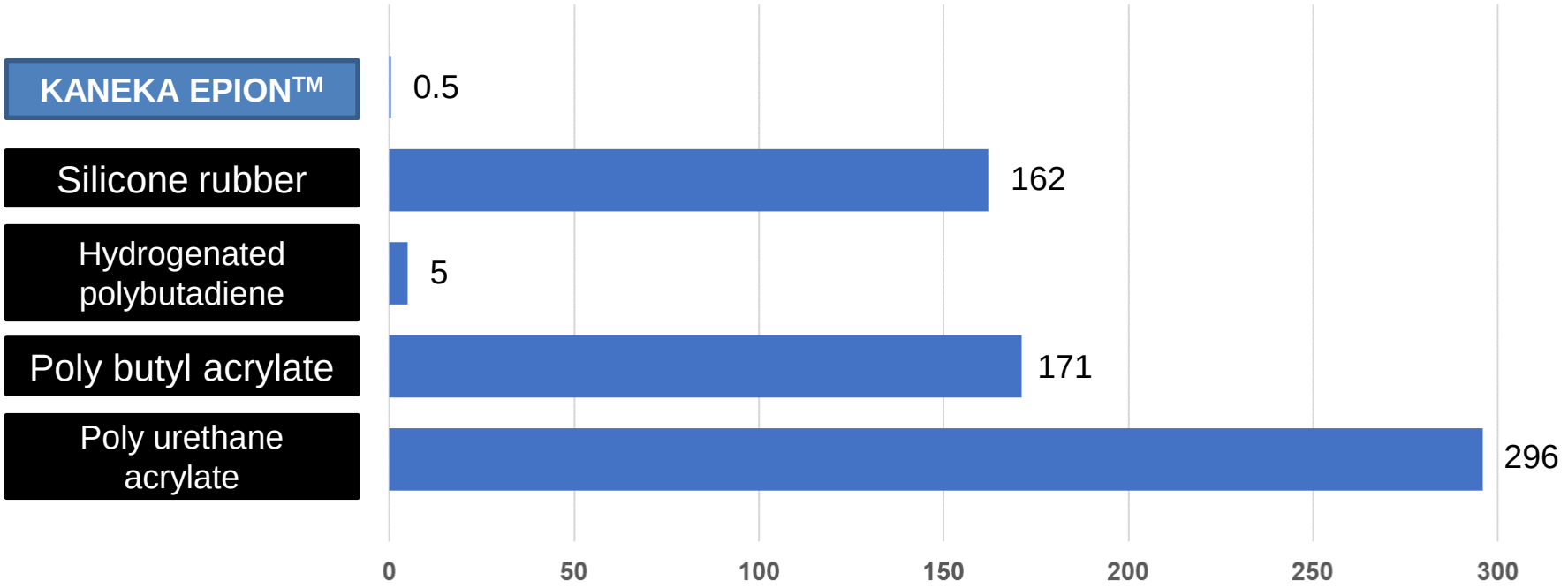
Grade Name	Type	Chemical Structure	Cure System
EP400V	Acryloyl-group-Terminated Polyisobutylene		UV or Heat (Radical curing system)

EP400V show unique characteristics.

- **Flexibility, Softness**
- **High gas and water vapor barrier properties**
- **Water resistance, Acid/Alkali resistance, Heat resistance, UV resistance**

KANEKA EPION™ is suitable an ingredient of gaskets for fuel cell, solar cell, Li-ion battery, LCD, OLED, e-Paper or other electronics.

Water vapor barrier property

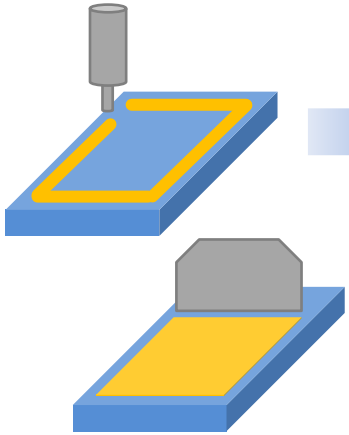


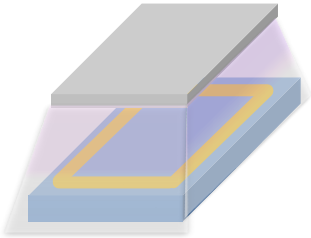
Water vapor permeability (g/m2・24hrs, 500μmthickness, 40 degC/90%Rh)

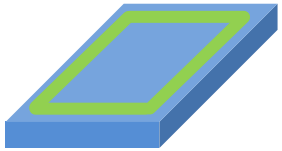
- KANEKA EPION™ shows much better water vapor barrier property than other materials.

How to use

1. Formulation　**2.** Application　**3. Curing**　**4.** Complete







- **EP400V**
- (Meta) Acrylic monomer
- Radical initiator
- Other additives
  （If required）

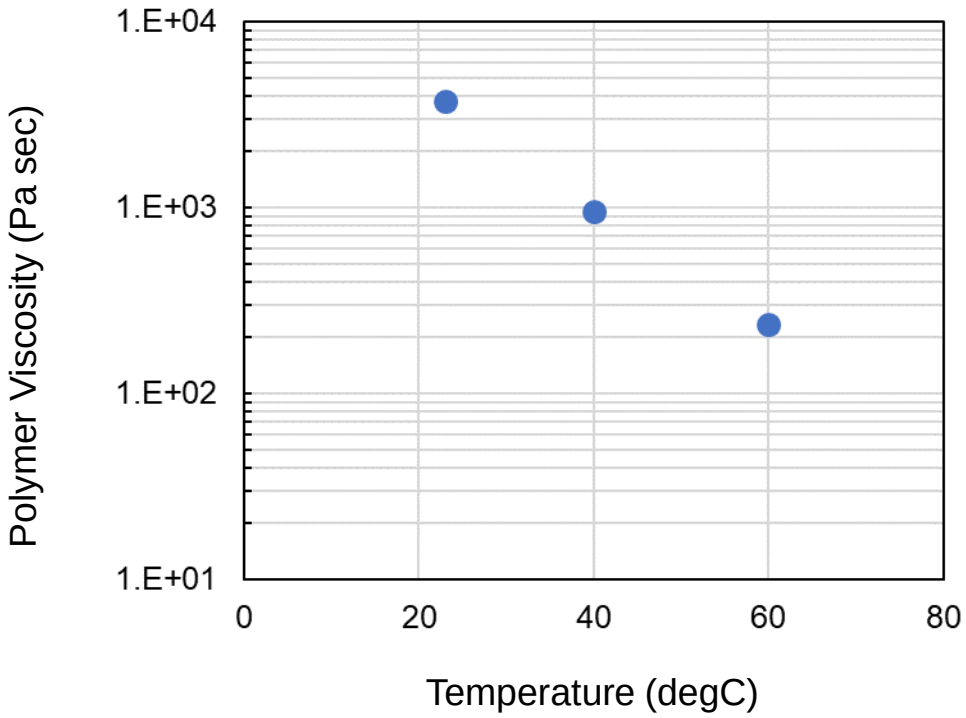
UV radiation

Formulation and Properties

			Run1	Run2
Formulation (phr)	Polymer	**KANEKA EPION™ EP400V**	100	100
	Anti-oxidant	**MARK AO-50** (ADEKA)	1.0	1.0
	Photo initiator	**DAROCUR1173** (BASF)	0.2	
		IRGACURE819 (BASF)	0.1	
	Radical initiator	Percumyl D		0.25
Property [1]	**Viscosity** (Pa･sec)	23 degC	**3,500**	
	Modulus at 50% Elongation (MPa)	JIS K 6251, No.3 dumbbell, 500 mm/min, 23 degC	**0.45**	**0.30**
	Tensile Strength (MPa)		**0.80**	**0.59**
	Elongation at break (%)		**100**	**135**
	Hardness (JIS A)	JIS K 6253	**35**	**21**
	Gel Fraction (%)	KANEKA Method (Immersion in solvent)	**95**	**96**
	Specific Gravity	g/cm^3	**0.93**	**0.93**
	WVTR (g/m^2･24hr)	500μm, 40degC, 90%RH	**0.38**	**-**
	Oxygen Transmission Rate (mol･m/m^2･sec･Pa)	23degC, 1atm	**3.4x10^{-16}**	-
	Volume Resistance (Ω･m)	JIS K 6271	**4.7x10^{15}**	-
	Compression Set (%)	JIS K 6262	**6%** @ 80degC/22h **6%** @ 150degC/22h	-

[Run1] Curing Condition: H-Valve, 530mW/cm^2, 3400mJ/cm^2, thickness of sample: 0.5mm
[Run2] Curing Condition: 180 degC 20min

Viscosity-Temperature Plot

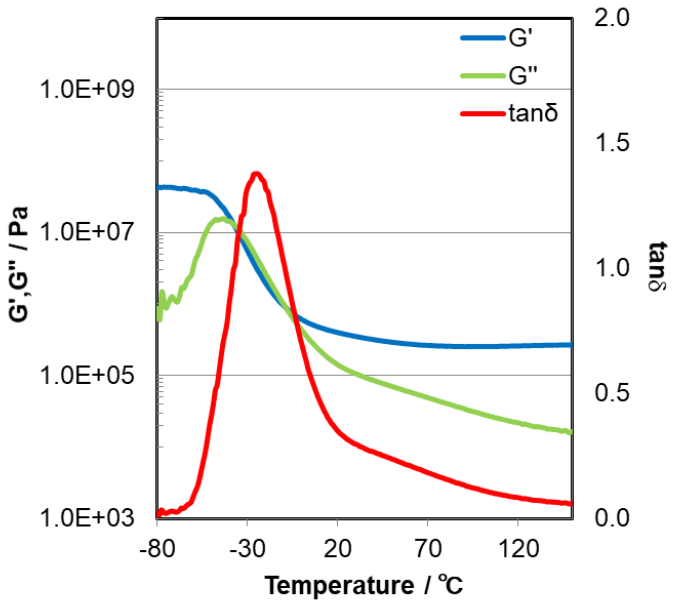


- Viscosity can be decreased with increasing temperature.

Dynamic viscoelasticity and Heat Resistance

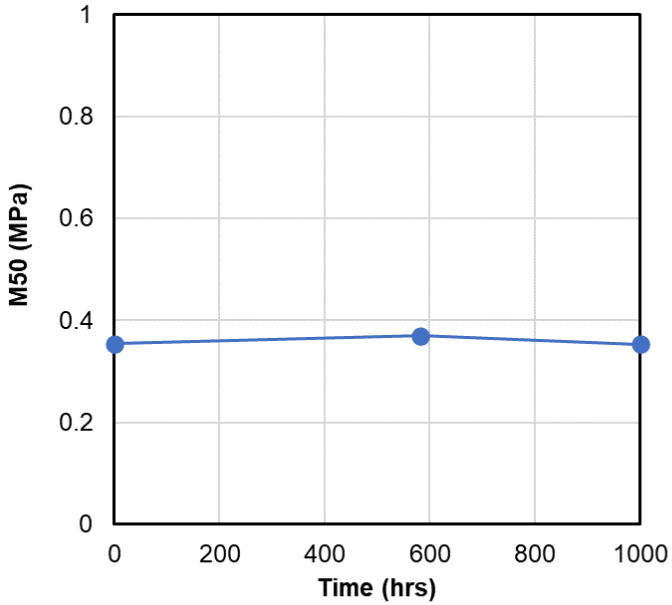
Dynamic viscoelasticity

(5Hz, Shear Mode)



Heat Resistance

(150 degC)



- EP400V exhibits high tanδ and heat resistance arising from polyisobutylene structure

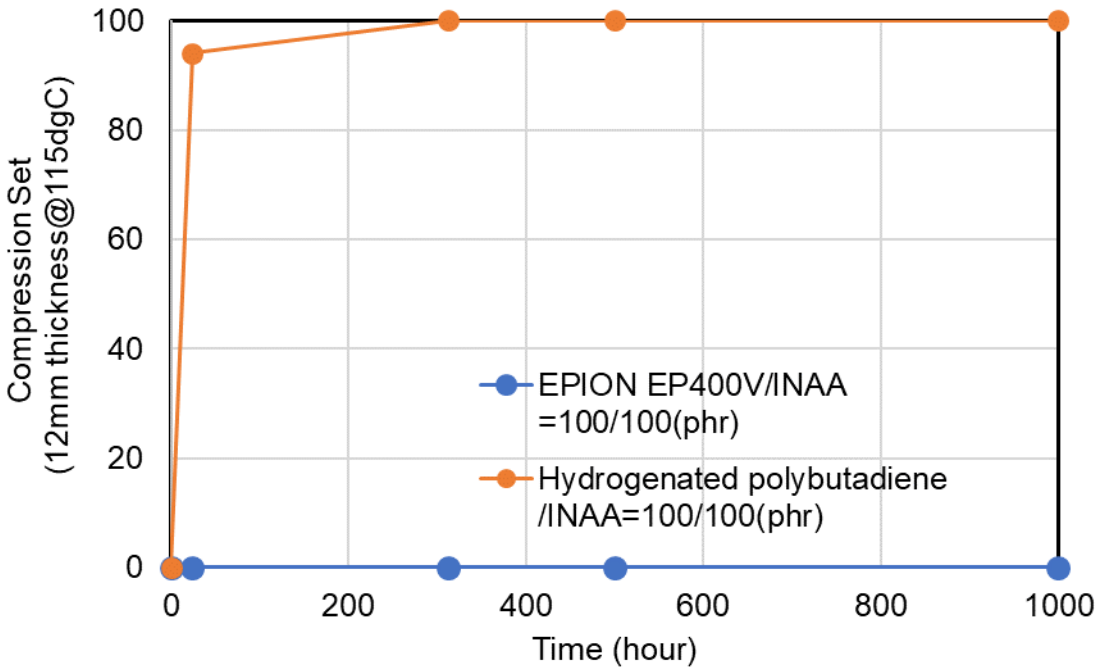
Chemical Resistance

	Change in Weight (%)	Change in Volume (%)
10% Hydrochloric acid	+/- 0	+/- 0
20% aqueous NaOH solution	+/- 0	+/- 0
Ethanol	+/- 0	+/- 0
Toluene	+ 154	-

Condition: JIS K 6258（23℃, 168h）

- EP400V has high resistance to acid, alkaline, and polar solvent.

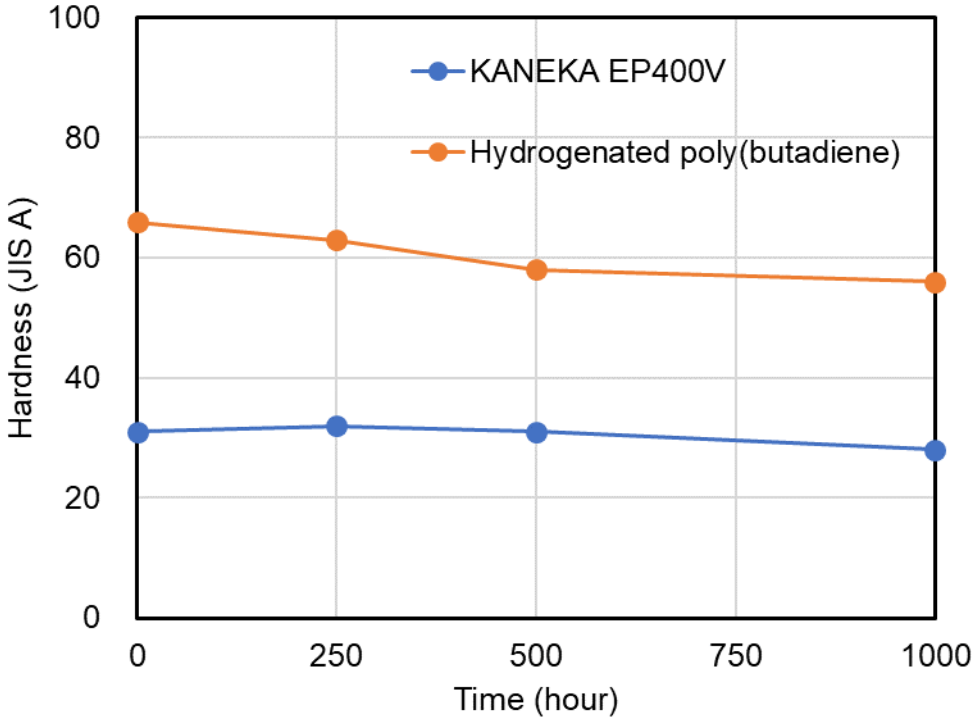
Compression set property at high temperature



【Formulation】 Polymer /iso nonyl acrylate (INAA)/UV radical initiator=100/0~100/0.3phr
【Curing condition】 H bulb、500mW/cm2, 5,000mJ/cm2、Air

- EP400V shows excellent compression set property.

Durability against Acid



【Formulation】 polymer/UV radical initiator=100/0~100/0.3phr;
【Curing condition】 H bulb、500mW/cm2, 5,000mJ/cm2、Air

- Durability against sulfuric acid（pH3, 95℃).
- EP400V is more stable in sulfuric acid than hydrogenated polybutadiene.

Miscibility to acrylic monomers

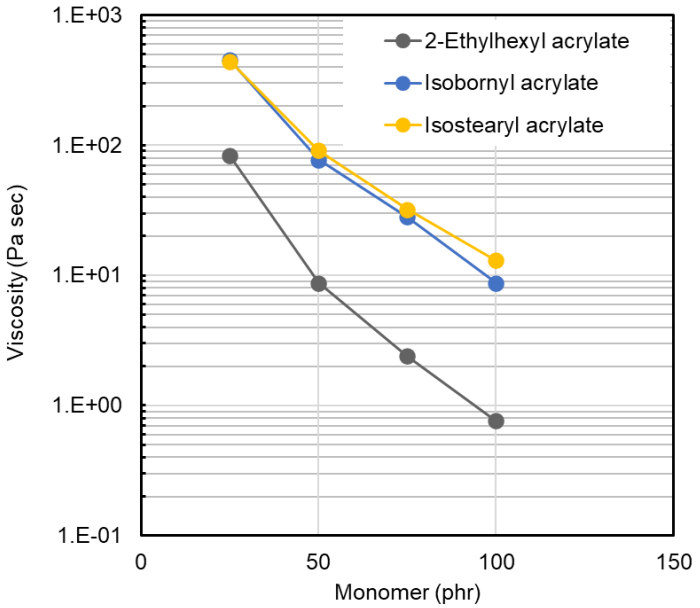
Miscibility to acrylic monomers

EP400V/monomer=100/50wt%, r.t., M: miscible, I: immiscible

Monomer	Miscibility
Butyl acrylate (BA)	M
2-Ethylhexyl acrylate (EHA)	M
Styrene (St)	M
Isooctyl acrylate (IOA)	M
Isononyl acrylate (INAA)	M
Lauryl acrylate (LA)	M
Isostearyl acrylate (ISTA)	M
Isobornyl acrylate (IBXA)	M
Dicyclopentanyl acrylate (DCPA)	M
Triethylene glycol diacrylate (3EG-A)	I
Neopentyl glycol diacrylate (NP-A)	I
Trimethylolpropane triacrylate (TMP-A)	I

Viscosity Change by adding acrylic monomers

Formulation: EP400V 100phr/ monomer 25-100phr



KANEKA Example of formulation for EP400V and monomers

		Run1	Run2	Run3	Run4	Run5	Run6	Run7
Formulation (phr)	**EP400V**	100	100	100	100	100	100	100
	MARK AO-50	1	1	1	1	1	1	1
	IOA		50					
	INAA			50				
	LA				50			
	ISTA					50		
	IBXA						50	
	DCPA							50
	Photo Initiator [1]	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Property [2]	**Viscosity** (Pa sec, 23degC)	3,500	9	10	12	106	82	85
	Modulus at 50% Elongation (MPa)	0.45	0.44	0.42	0.37	0.37	0.85	1.70
	Tensile Strength (MPa)	0.80	0.68	0.61	0.58	0.76	3.92	6.39
	Elongation at break (%)	100	93	98	95	127	246	240
	Hardness (JIS A)	35	38	37	36	36	44	55
	Gel Fraction (%)	95	97	96	96	97	97	97
	Surface resistance (Ω)	3.8×10^{15}	-	-	-	1.3×10^{16}	2.1×10^{15}	-
	Volume resistance (Ω x cm)	4.7×10^{15}	-	-	-	9.0×10^{16}	5.0×10^{14}	-

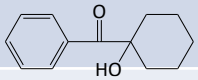
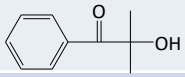
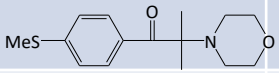
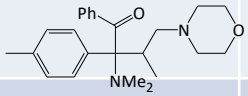
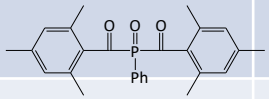
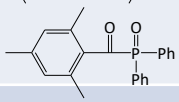
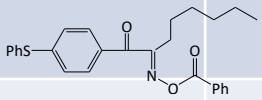
[1] Photo Initiator : Darocur1173/Irgacure819=0.2phr/0.1phr
[2] Curing Condition : H-Valve, 530mW/cm^2, 3400mJ/cm^2, thickness of sample: 0.5mm

Adhesion to various materials

		Run1		Run2		Run3		Run4	
Formulation (phr)	EP400V	100		100		100		100	
	MARK AO-50	1		1		1		1	
	IOA			50					
	ISTA					50			
	IBXA							50	
	Photo Initiator [1]	0.3		0.3		0.3		0.3	
Adhesion [2][3] (N/25mm)	Storage period (r.t.)	1h	3days	1h	3days	1h	3days	1h	3days
	SUS	0.6	6.0	0.3	0.4	3.5	4.3	7.0	6.0
	PP	0.8	3.0	1.2	1.7	9.0	9.0	18	21
	PC	1.0	1.5	1.0	1.1	6.0	5.5	21	18
	PMMA	1.0	1.2	1.2	1.2	6.0	5.0	20	19
	Glass	0.6	5.5	0.3	0.2	2.5	2.5	6.5	6.1

[1] Photo Initiator : Darocur1173/Irgacure819=0.2phr/0.1phr
[2] Curing Condition : H-Valve, 530mW/cm^2, 3400mJ/cm^2, thickness of sample: 0.5mm
[3] Test Conditions : 25μmPET, 50μm thickness of adhesive layer, 180°peel, 300mm/min

Deep-section Curability with various initiators

	H-Valve, open air (400mW/cm^2, 2,000mJ/cm^2)		UV-LED, 365nm, open air (400mW/cm^2, 4,000mJ/cm^2)	
	0.3phr	2.0phr	0.3phr	2.0phr
Irgacure651 	6.4 mm	2.0 mm	4.7 mm	2.5 mm
Irgacure184 	11.0 mm	3.4 mm	Only thickening	5.9 mm
Darocure1173 	6.0 mm	4.5 mm	Only thickening	6.2 mm
Irgacure907 	3.7 mm	2.0 mm	3.3 mm	3.3 mm
Irgacure379 	5.0 mm	5.2 mm	4.6 mm	1.5 mm
Irgacure819 	12.3 mm	2.0 mm	2.0 mm	1.1 mm
Irgacure TPO 	11.4 mm	2.5 mm	Only thickening	1.0 mm
Irgacure OXE01 	3.1 mm	n.d.	2.0 mm	n.d.
Irgacure754	12.6 mm	Only thickening	2.0 mm	Only thickening
4-methylbenzophenone	9.4 mm	2.3 mm	5.2 mm	2.2 mm