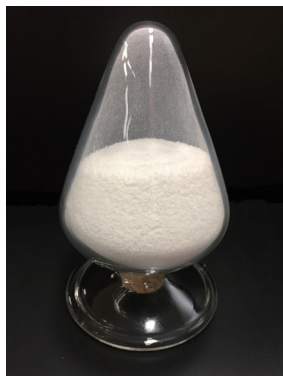


# 透明ポリイミド用モノマー「ENEHYDE (エネハイド)®」

Monomer for Colorless Polyimide 「ENEHYDE®」

## ● 当社製品 Our new monomer ●



◎ 脂環式構造を導入した新規モノマー  
We introduced Alicyclic Structure into the Monomer

サンプル提供可  
(担当者までご相談ください)

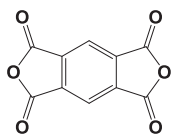
Monomer sample is available

## ● 用途 Applications ●

当社モノマーの特長 Features of Our new monomer

ポリイミドに優れた性能を付与 Our new monomer provides excellent properties to your polyimide

従来モノマー  
Conventional  
Monomer

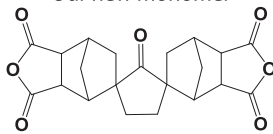


剛直な骨格 Rigid Structure

芳香族骨格 Aromatic Structure

**CpODA**  
当社製品

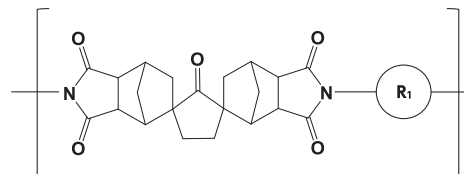
Our new monomer



剛直な骨格 Rigid Structure

脂環式骨格 Alicyclic Structure

CpODAから得られるポリイミド  
CpODA-based Polyimide



高耐熱 Highly heat-resistant

低線膨張率 Low CTE

無色透明 Colorless

当社モノマーより得られるポリイミドの想定用途 Applications

◎ フレキシブルディスプレイ材料  
Flexible display materials

◎ フレキシブルプリント基板  
Flexible printed circuits

◎ 絶縁膜  
Insulating film

加工例  
Example photo



例:ポリアミック酸/ポリイミドワニス  
Example of Varnish



例:透明ポリイミドフィルム  
Example of colorless polyimide film

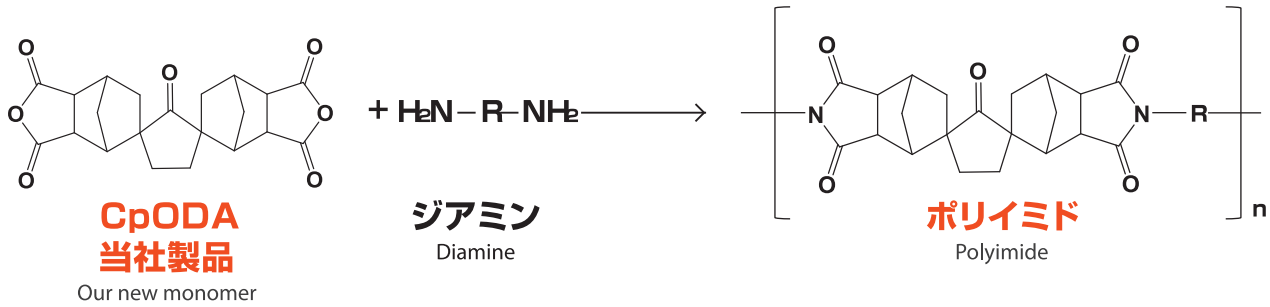


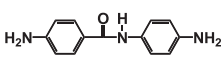
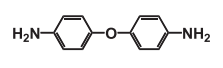
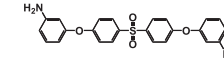
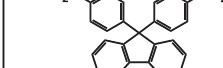
ENEOS 株式会社

# 透明ポリイミド用モノマー「ENEHYDE(エネハイド)®」

Monomer for Colorless Polyimide 「ENEHYDE®」

## ● CpODAから得られるポリイミドの特長 CpODA-based PI Data ●



		Low CTE	Standard	Low Rth	High Tg
酸二無水物 Dianhydride		CpODA			
ジアミン Diamine		 DABA	 ODA	 BAPS-M	 FDA
ワニス種類 Varnish type		PAA varnish	PAA varnish	PAA varnish	PI varnish
溶剤 Solvent		DMAc	DMAc	DMAc	DMAc/GBL* <sup>4</sup> (1/1)
膜厚, μm Thickness		5	32	18	60
熱物性 Thermal properties	Tg* <sup>1</sup> , °C	<b>427</b>	354	288	<b>&gt;450</b>
	Td <sub>5%</sub> , °C	452	493	481	506
	CTE, ppm/K	<b>15</b>	49	58	45
光学物性 Optical properties	全光線透過率* <sup>2</sup> , % Total Transmittance	88	—	—	89
	Haze* <sup>2</sup> , %	0.68	<b>0.89</b>	<b>0.50</b>	0.74
	YI* <sup>3</sup>	2.6	<b>1.8</b>	<b>0.71</b>	1.4
	Rth, nm* <sup>5</sup> (@10 μm)	837	136	<b>8</b>	<b>41</b>

\*1: by TMA, \*2: by Haze meter, \*3: E313-05(C)

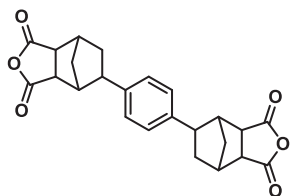
\*4: DMAc = N,N'-Dimethylacetamide, GBL = γ-Butyrolactone

\*5: by prism coupler



**ENEOS株式会社**

### ● 当社開発品 Our New Monomer (R&D stage) ●

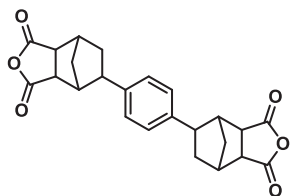


### BzDA

当社開発品  
New Monomer  
(R&D stage)

#### モノマーの特長 Features of our monomer

- ◎ 脂環式構造 → 高耐熱・高透明PI  
Alicyclic Structure Highly heat-resistant colorless PI
- ◎ 様々なジアミンと可溶性PIを作製可能  
Solution imidization with various diamines

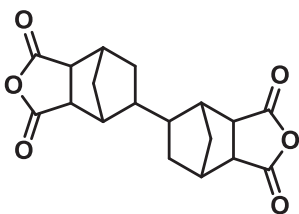


### BzDAxx

当社開発品  
New Monomer  
(R&D stage)

#### モノマーの特長 Features of our monomer

- ◎ BzDAの構造を改良し、反応性が向上  
Diastereomer of BzDA, high reactivity
- ◎ 様々なジアミンとの重合を可能とし、低CTE化  
Polymerization with various diamines, Low CTE PI



### BNBDA

当社開発品  
New Monomer  
(R&D stage)

#### モノマーの特長 Features of our monomer

- ◎ 脂環式構造 → 高耐熱・高透明PI  
Alicyclic Structure Highly heat-resistant colorless PI
- ◎ 低CTE / 低Rthの両立  
Low CTE and Low Rth PI
- ◎ 低誘電正接 → 5G対応材料に好適  
Low Df PI Suitable for 5G applications

● 当社開発品から得られるポリイミドの特徴 ENEHYDE® based PI Data ●

◎ BzDA

◆ 半脂環式PIの溶解性 Solubility of semi-aliphatic PI

	BzDA	HPMDA	CBDA	CpODA
DABA	○	×	×	×
ODA	○	○	×	×
TFMB	○	×	×	×

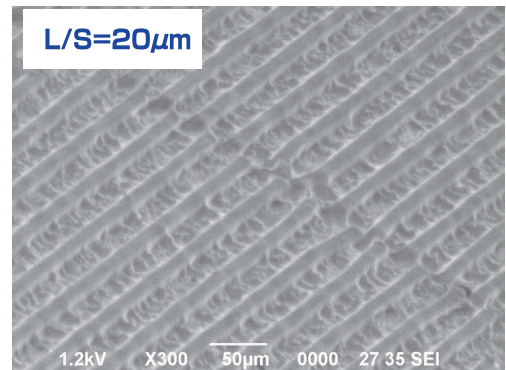
※condition: 180°C, DMAc/GBL(1/1), 20~40wt%

→ Tg: 403°C, CTE: 54 ppm/K, YI: 0.54

◆ ポジ型のパターン形成例(感光性PI)

(ご協力: 横浜国立大学様)

Example of positive resist composition and resist pattern formation



※PI: BzDA/Bis-AP-AF

※condition: 2,000 mJ/cm<sup>2</sup>, 2.38wt%TMAH aq., 2.6min

◎ BzDAxx

◆ 代表的なPI物性 BzDAxx-based PI Data

Diamine	DABA	ODA	TFMB	BPTP
solvent	TMU	DMAc	DMAc	NMP
Tg, °C	375	351	378	431
CTE, ppm/K	20	58	51	22
YI	5.3	4.2	1.6	8.2
Rth, nm	848	24	122	1,006

※varnish type: PAA(DABA, ODA, BPTP), PI(TFMB), thickness: 10-20µm

※ TMU = Tetramethylurea, NMP = N-methylpyrrolidone

◎ BNBDA

◆ 代表的なPI物性(ご協力: 東邦大学様) BNBDA-based PI data

Acid	BNBDA(70) / 6FDA(30)	BNBDA(100)	BNBDA(100)
Diamine	TFMB(80) / 3,4-ODA(20)	ODA(100)	APBP(100)
Tg, °C	362	378	298
CTE, ppm/K	27	51	56
YI	2.2	2.1	2.0
Rth, nm	389	67	85
Dk / Df	2.88 / 0.0143	—	3.14 / 0.0116

※varnish type: PI(TFMB), thickness: 10-20µm, Dk/Df: 10GHz 空洞共振器法 (Cavity resonator method)

