

**ARON OXETANE**

**OXT-212**

**TOAGOSEI CO., LTD.**

## ***What is Oxetane***

Oxetanes, 4-membered cyclic ethers, are new cationic monomers for UV-cure system developed by Toagosei Co.,Ltd. With high basicity and ring strain, oxetane compounds have highest ring-opening polymerizability among various cyclic ethers including epoxy compounds.

Although oxetane was recognized as an excellent cationic monomer, few industrial applications had been developed. We paid attention to the potential of oxetane as a new UV-cure monomer and have established industrial manufacturing recently. With its beneficial performances as photo-curable monomer, we believe oxetane helps cationic system broaden its application field.

## ***Benefits of Cationic System***

In comparison with conventional radical cure systems, cationic systems generally have the following benefits.

- ① Low Shrinkage → Excellent Adhesion to Substrates, High Gloss
- ② Low Skin Irritation → High Safety and Processibility
- ③ No Oxygen Inhibition → Fast Cure even on Thin Film

## ***Benefits of Oxetane***

Additionally, oxetane compounds have the following benefits compared with conventional epoxy compounds.

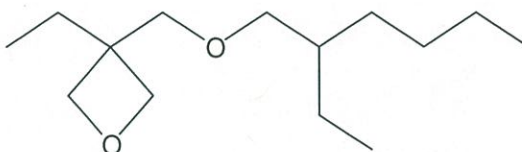
- ① Rapid Polymerization → High Molecular Weight, Resilient and Durable Film Properties
- ② Cure Improvement by formulating with Epoxy Compounds  
→ High Manufacturing Efficiency, Low Initiator content required
- ③ Not Mutagenic → High Safety
- ④ No Generation of -OH → Water and Humidity Resistance, Excellent Electric Properties
- ⑤ Excellent Stability under High Temperature or Basic Condition → Long Shelf Life

We have been pursuing R&D of Oxetanes for many years and hold wide-ranged patent licences. Please contact us before using oxetanes.

## OXT-212 (EHOX)

EHOX has an oxetanyl functional group which has polymerization ability. EHOX has excellent diluency, cure-promoting effects and improves the softness of cured films. EHOX has the lowest surface tension of the oxetane compounds. Using EHOX improves the leveling of paints, inks and coatings. It produces excellent films.

Product Name: ARON OXETANE OXT-212(EHOX)  
Chemical Name: 3-ethyl-3-[(2-ethylhexyloxy)methyl]oxetane  
Abbreviated Name: EHOX (Ethyl Hexyl Oxetane)  
Chemical Structure:



|                                |                  |                      |                        |
|--------------------------------|------------------|----------------------|------------------------|
| Purity:                        | >95%             | Molecular Weight:    | 228.4                  |
| Appearance:                    | clear liquid     | Boiling Temperature: | 133 °C/10 mmHg         |
| Melting Temperature:           | <-20°C           | Specific Gravity:    | 0.892 (25°C)           |
| Viscosity:                     | 5.0 mPa·s (25°C) | Flash Point:         | 130°C(OPEN CUP)        |
| Primary Irritation Index(PII): | 3.1              | CAS No.:             | 298695-60-0            |
| Ames Test:                     | Negative         | TSCA Inventory:      | Now proceeding         |
|                                |                  | EINECS No.:          | Now proceeding(ELINCS) |

Main Applications: Coatings, Inks

Benefits: Improve the leveling, high diluency, high cure response

## Test Formulation 1 (EHOX/Cycloaliphatic Epoxide)

Formulations with cycloaliphatic epoxide, available as photo-cationic monomer, were investigated and the cured film properties were estimated.

| N o .                                    |  | 1           | 2       | 3       | 4      | 5      |   |
|--|--|-------------|---------|---------|--------|--------|---|
| Formation                                | E H O X (phr)  | 0           | 1 0     | 2 5     | 5 0    | 7 5    |   |
|  | Cycloaliphatic Epoxide <sup>3)</sup> (phr)           | 1 0 0       | 9 0     | 7 5     | 5 0    | 2 5    |   |
|  | Cationic Photoinitiator <sup>4)</sup> (phr)          | 2           | 2       | 2       | 2      | 2      |   |
|  | Miscibility  | ○           | ○       | ○       | ○      | ○      |   |
|  | Viscosity <sup>5)</sup> (mPs·s)                      | 3 3 0       | 1 6 0   | 7 1     | 2 3    | 1 0    |   |
| For Thin coated film <sup>1)</sup>       | Pencil Strength                                      | 3 H         | F       | F       | F      | < 6 B  |   |
|  | Adhesion <sup>7)</sup>                               | 100/100     | 100/100 | 100/100 | 50/100 | 18/100 |   |
|  | Flexural Test <sup>8)</sup>                          | 10mm $\phi$ | ×       | ○       | ○      | ○      | ○ |
|  |  | 2mm $\phi$  | ×       | ○       | ○      | ○      | ○ |
| For Thick coated film <sup>2)</sup>      | Acetone Extractability <sup>6)</sup> (%)             |             |         |         |        |        |   |
|  | Tensile Strength <sup>9)</sup> (kg/cm <sup>2</sup> ) | 9 2         | 2 0 0   | 2 1 0   | 1 3 0  | 1 6    |   |
|  | Elongation at Break <sup>9)</sup> (%)                | 1.7         | 1.0     | 2.0     | 2.0    | 17.0   |   |
|  | Tensile Modulus <sup>9)</sup> (kg/cm <sup>2</sup> )  | 5,700       | 16,500  | 10,800  | 6,200  | 90     |   |
|  | E "max <sup>10)</sup> (°C)                           | 1 6 3       | 1 3 1   | 1 0 2   | 4 7    | - 1 4  |   |
|  | tan $\delta$ max <sup>10)</sup> (°C)                 | 1 8 8       | 1 5 5   | 1 2 3   | 8 0    | 1 4    |   |
|  | Specific Gravity                                     | 1.2 3       | 1.2 0   | 1.1 6   | 1.0 8  | 1.0 0  |   |
| Shrinking with Curing <sup>11)</sup> (%) | 5.0  | 4.6         | 4.5     | 4.3     | 4.1    |        |   |

1) Coated film thickness = About 10  $\mu$  m, Substrate: Chroming steel Al plate

Irradiation condition = 80W high press. mercury lamp / lamp height 10cm / conveyor speed 10m/min. 2 pass

2) Coated film thickness = 100-200  $\mu$  m, Substrate: OPP film

Irradiation condition = 80W high press. mercury lamp / lamp height 10cm / conveyer speed 10m/min. 6 pass

3) 3,4-Epoxy cyclohexylmethyl-3,4-Epoxy cyclohexylcarboxylate (DOW UVR 6110, Daicel Chemical Celoxide 2021p)

4) Diaryliodonium - Hexafluoroantimonate (Sartomer CD-1012)

5) Rotary Viscometer type E at 25°C 6) Dipped in Acetone for one day and dried. Calculation with loss of weight

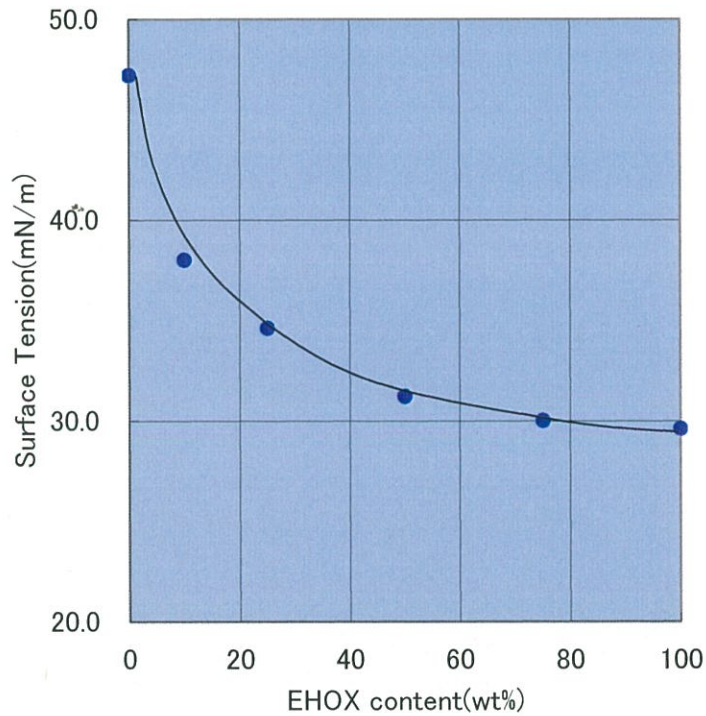
7) Cross-cut adhesion test 8) Flexural test 9) Tensile speed = 200mm/min. Chuck interval = 100mm

10) Dynamic modulus measurement: 10Hz, Speed on rising temp. : 4 °C/min

11) Calculation from specific gravity between the cured item and each of the raw materials.

- EHOX has an oxetanyl function and improves softness of cured film.
- EHOX has the lowest viscosity in oxetane compounds, so it gives low viscosity formulations.

## Surface Tension values of the formulation with EHOX



Surface Tension values versus EHOX content in Cycloaliphatic epoxide (at 20°C)

EHOX has the lowest surface tension of the oxetane compounds. Using EHOX improves the levelling of paints, inks and coatings. It produces excellent films.

## ***Precautions in Handling***

Primary Irritation Index(PII) of EHOX is 3.1, which means moderate irritant to skin. Therefore, skin contact of EHOX may cause a rash or chemical burn. EHOX is highly reactive and may polymerize by heat, light, or contamination with a foreign substance. When handling EHOX, the following precautions should be taken to avoid accidents.

### **【Handling】**

1. Do not handle EHOX near fire or heat sources.
2. Use with adequate ventilation. Avoid breathing vapor.
3. Wear appropriate protective equipment such as protective gloves, goggles, and safety glasses. Avoid direct contact with eyes, skin, mucous membranes and clothing.
4. In case of spilling, wipe up with towel and dispose by incineration or absorb on inert mineral filler and collect in a closed container.
5. Wash hands sufficiently after handling EHOX.

### **【First Aid Measures】**

1. In case of skin contact, immediately wash with lots of soap and water. Remove contaminated clothing and shoes. Get immediate medical attention if irritation persists after washing.
2. In case of eye contact, immediately flush eye with lots of running water for at least 15 minutes. Get immediate medical attention.
3. If inhaled, remove person to fresh air. If not breathing, give artificial respiration and get medical attention immediately.
4. If swallowed, get immediate medical attention. Do not give anything to an unconscious or convulsing person.

### **【Storage】**

1. Store in a cool dark place in original packaging.
2. Keep container closed to avoid absorbing moisture.

### **【Waste Disposal method】**

Send to a licensed reclaimer or to a permitted incinerator.

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For more detailed information about EHOX, please refer to Material Safety Sheet. Feel free to contact the following address for inquiry or request of samples and related documents.

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