High-Performance Materials for Enhancing Coatings, Adhesives, and More

TOAGOSEI's Proprietary High-Performance Materials

Contact Us

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ARONFIBRO® Series	(1) Polymer & Oligomer Division, Cellulose Nanofiber Department	acryl@toagosei.co.jp
Photocurable SQ Series	(2) New Product Development Division, Mobility Department	adhesive@toagosei.co.jp
ARUFON® Series	(3) Polymer & Oligomer Division, Polymer Department	acryl@toagosei.co.jp
IXE® Series	(4) High-Performance Inorganic Materials Division, Inorganic Functional Materials Department	new-inorganic@toagosei.co.jp

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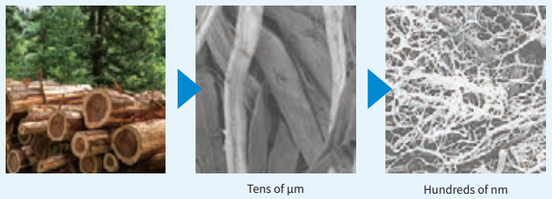
1 Functional Nanomaterial Cellulose Nanofiber "ARONFIBRO® Series"

Utilizing our proprietary high-concentration sodium hypochlorite, TOAGOSEI has developed ARONFIBRO, a cellulose nanofiber (CNF) raw material produced through a unique process that readily defibrillates wood fibers.

■ Production of Cellulose Nanofibers

Wood → Pulp → Cellulose Nanofibers



Tens of μm

Hundreds of nm

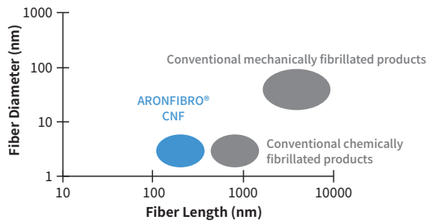
■ Application Examples

Paints and coatings
(emulsion, waterborne, solvent-based, etc.)

Reinforcement for rubber compounds
(hoses, belts, etc.)

■ Features

(1) ARONFIBRO-derived CNF exhibits a shorter fiber length and smaller fiber diameter compared to competing products.



(2) Advantages of shorter fiber length and smaller fiber diameter

Allows for higher loading levels compared to competing CNFs, enabling enhanced strength in paints and adhesives.

ARONFIBRO (10% loading)

Competing CNF (2% loading)

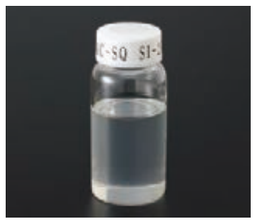
2 Organic-Inorganic Hybrid Material "Photocurable SQ Series"

The Photocurable SQ Series is an organic-inorganic hybrid material created by introducing photoreactive components (organic units) into an SQ framework (inorganic unit).

■ Features of Cured SQ Materials

- High hardness with excellent abrasion resistance
- High transparency
- Excellent heat and weather resistance
- High water repellency without fluorine (specific grades)
- Eight grades available for specific objectives

■ Appearance of SQ (Specific Grade)



AC-SQ SI-20 Appearance

HTV (Kounotori) Unit 3
(SQ coating on identification mark)

■ Application Examples

Scratch- and stain-resistant coatings for televisions, smartphones, and foldable devices

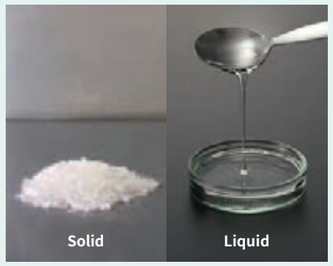
Scratch- and stain-resistant coatings for eyeglass and AR glass lenses

Release agents for nanoimprinting, suitable for optical films and other applications

3 Solvent-Free Acrylic Polymer for Enhanced Flexibility, Weatherability, and Adhesion "ARUFON® Series"

"ARUFON" is the brand name for a group of acrylic polymers produced using UFO (Uniform Functional Oligomer) technology.

UFO technology is a high-temperature, continuous polymerization process for the efficient production of 100% low-molecular-weight polymers from compositions consisting mainly of acrylic monomers.



Appearance of ARUFON
(Available in solid and liquid forms, depending on the grade)

■ Features of ARUFON

- Serves as a plasticizer (to impart flexibility) for PVC, epoxy, modified silicone, and acrylic resins
- Improves the adhesive strength of UV-curable adhesives
- Six series with numerous grades available for specific objectives

■ Application Examples

Plasticizers (flexibility-imparting agents) for PVC sheets and films

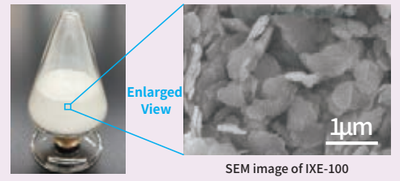
Sealing compounds

Semiconductor encapsulants

Adhesives

4 Inorganic Ion Scavenger "IXE® Series"

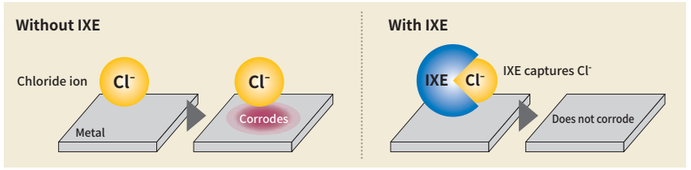
IXE is an ion scavenger combining excellent ion-capturing capability with high heat resistance. It improves the reliability of electronic materials by capturing impurity ions.



SEM image of IXE-100

■ Features of IXE

- Improves the durability of electronic devices by capturing a wide range of ions, including Na^+, Cl^-, and Cu^{2+}
- Heat resistance exceeding 250°C
- Three series with numerous grades available for specific objectives



■ Application Examples

Adhesives for FPCs (Flexible Printed Circuits)
*For bonding copper foil to PET film, etc.

Semiconductor encapsulants

Solder resists
*Prevents solder adhesion on electronic circuit boards

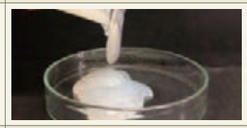
1 ARONFIBRO® Series

Functional Nanomaterial
Cellulose Nanofiber

Intended Applications: Inks, Paints, Inkjet Printing, 3D Printing, Nanoimprinting, Cosmetics, Rubber

Grades

ARONFIBRO is available in three types: hydrophobic, aqueous, and rubber.
The hydrophobic type is designed for formulation into solvent-based products, the aqueous type for waterborne products, and the rubber type for rubber products.

Classification	Type	Appearance	Applications
Hydrophobic	Acetyl-Modified CNF	 Form: Acetone dispersion Concentration: 1–5%	Coating agents, adhesives
Aqueous	Readily Defibrillated Oxidized Cellulose "ARONFIBRO®"	 Form: Slurry Concentration: Approx. 10 wt% Dispersion Medium: Water	Waterborne products (paints, adhesives, etc.)
Rubber	CNF Masterbatch "ARONFIBRO® MB"	 Form: Sheet Concentration: 15–20 phr (per hundred rubber) Rubber: Natural Rubber, NBR, etc.	Rubber products

Samples Acetyl-Modified CNF: Please inquire
ARONFIBRO: 500g
ARONFIBRO MB: 1kg (Fee applies)

Application Examples

■ Hydrophobic Type

Solvent-Based UV-Curable Hard Coat

[Applications]

Smartphones Foldable Smartphones

Formulation	Ratio
Multifunctional Oligomer (ARONIX M-305 (TOAGOSEI))	57
Monofunctional Monomer	38
Acetone	100
Acetyl-Modified CNF	5
Photoinitiator	5

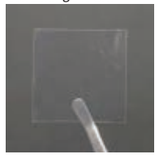
[Formulation Test Results]

● Pencil Hardness Test

With 5% addition, pencil hardness is 4H and the film is transparent.

Filler Type \ Addition Level	Unformulated	2%	5%	10%
Acetyl-Modified CNF	H	3H	4H	3H
Hydrophobized Silica (φ100nm)	H	H	2H	4H

Coating Film Containing 5% CNF



● Mandrel Bend Test

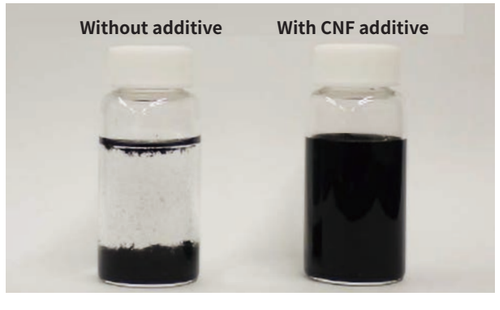
With 5% addition, no cracking at a 4 mm diameter. Key Differentiator

Filler Type \ Addition Level	Unformulated	2%	5%	10%
Acetyl-Modified CNF	12mm	8mm	4mm	6mm
Hydrophobized Silica (φ100nm)	12mm	8mm	8mm	10mm

■ Aqueous Type

Dispersion of CNTs (Carbon Nanotubes) and Inorganic Nanomaterials

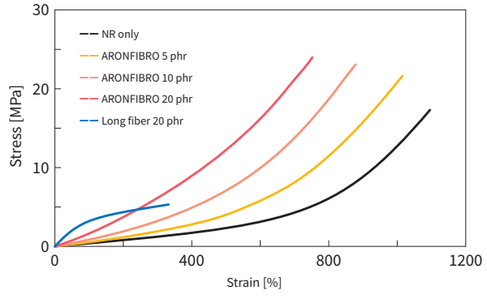
The addition of ARONFIBRO prevents the sedimentation of carbon nanotubes.



■ Use in Rubber Compounding

Composite with Natural Rubber

The addition of ARONFIBRO increases elastic modulus and strength.



2 Photocurable SQ Series

Organic-Inorganic Hybrid Material

Intended Applications: Paints, Nanoimprinting

Grades

These materials exhibit higher hardness, heat resistance, and durability than conventional organic materials, and, compatible with both radical and cationic polymerization methods, our lineup includes grades with various features, with those incorporating silicone (SI) offering water and oil repellency.

Polymerization Method	Type	Grade	Heat Resistance *1	Pencil Hardness (Substrate: Steel Plate)	Features
Radical Curing ・Excellent compatibility with various acrylic monomers ・High hardness, high heat resistance	Acrylate	AC-SQ TA-100	⩾390°C	⩾6H	High hardness
	Methacrylate	MAC-SQ TM-100			High hardness
	Acrylate + SI	AC-SQ SI-20			Water/oil repellency
	Methacrylate + SI	MAC-SQ SI-20			Water/oil repellency
	Increased Inorganic Content	MAC-SQ HDM	380°C		NV 50%; high abrasion/scratch resistance
Cationic Curing ・Excellent compatibility with aliphatic/alicyclic epoxies ・Low curing shrinkage (2–5%)	Oxetane	OX-SQ TX-100	⩾390°C	5H	High hardness
	Oxetane + SI	OX-SQ SI-20		3H	Water/oil repellency
	Increased Inorganic Content	OX-SQ HDX	300°C	—	NV 50%; high abrasion/scratch resistance

*1 Temperature at 5% weight loss in nitrogen
Samples: 100g, 1kg (Fee applies for both)

Application Examples

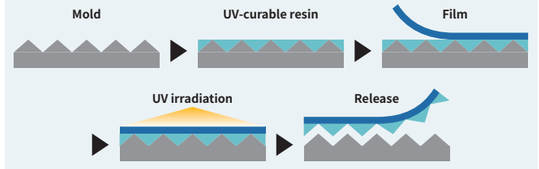
■ Formulation Examples of AC-SQ SI-20 in Hard Coats and Nanoimprinting

(1) Final Product Examples

For scratch/stain resistance on televisions, smartphones, and foldable devices, and for use in optical films

[About Nanoimprinting]

A technology for producing films with a high density of nanoscale surface features



For optical films, etc.

(2) Effect

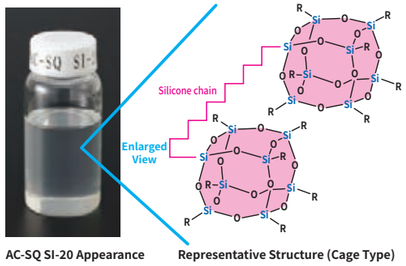
The addition of just a few percent provides excellent water/oil repellency and release properties while minimizing any reduction in hardness.

Water/Oil Repellency Additive (Silsesquioxane Derivative AC-SQ SI-20)
This proprietary TOAGOSEI organic-inorganic hybrid material imparts excellent water/oil repellency at addition levels of just a few percent.

[Features]

・Fluorine-free
・Maintains higher hardness than conventional additives
・Resistant to bleed-out and possesses high heat resistance

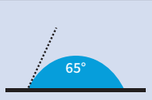
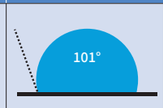
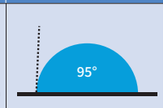
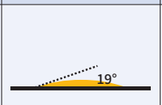
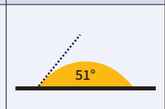
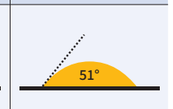
■: **SQ framework** (inorganic unit)
R: Photoreactive component (organic unit)



AC-SQ SI-20 Appearance
(Viscosity: 8,000 mPa・s)

Representative Structure (Cage Type)

●Contact Angles and Surface Hardness with SQ Addition

	Unformulated	Coating Agent with AC-SQ SI-20 Added	Comparison: Commercial Fluorine-Containing Product
Water Contact Angle	 65°	 101°	 95°
Oleic Acid Contact Angle (oil component)	 19°	 51°	 51°
Surface Hardness	○	○ (Hardness maintained) Key Differentiator	△ (Hardness reduced)
Solvent Resistance (No change in contact angle after solvent abrasion)	—	○	×

A hard-coat formulation containing 1 wt% solids of the anti-stain additive was coated onto PET film to a thickness of 10 μm and cured.

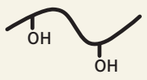
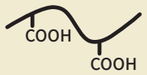
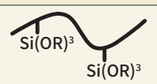
3 ARUFON® Series

Solvent-Free Acrylic Polymer for Enhanced Flexibility, Weatherability, and Adhesion

Intended Applications: Paints, Adhesives, Sealing Compounds

Grades

Six series are available, including non-functional types and types with functional groups such as hydroxyl or carboxyl groups. Each series offers grades with varying molecular weights and numbers of functional groups.

	Series	Structure	Applications	Effects
Non-Functional Polymer	UP-1000		・**Sealing compounds** for building exteriors ・Plasticizers for various **plastics** ・**Melt flow modifiers** for plastics processing ・**Leveling agents** for paints	・Improved durability ・Improved weatherability ・Improved heat resistance ・Improved resistance to repeated elastic fatigue ・Improved flowability
Hydroxyl (OH)-Containing Polymer	UH-2000		・**Base resins** for **acrylic urethane paints, adhesives,** and **sealing compounds**	・Improved durability ・Improved weatherability ・Improved heat resistance ・Improved resistance to repeated elastic fatigue
Carboxyl (COOH)-Containing Polymer	UC-3000		・Additives and **coating agents** for waterborne systems ・**Pigment dispersants** ・**Dispersants for emulsions**	・Can be solubilized via neutralization in alkaline water
Epoxy Group-Containing Polymer	UG-4000		・**Improves extrudability of** (recycled) **PET resin** ・**Improves adhesion of adhesives and sealing compounds**	・Resin modification and compatibility improvement via reactions with hydroxyl, carboxyl, and amide groups
Long-Chain Alkyl and COOH Group-Containing Polymer	UF-5000		・**Additives** and **coating agents for waterborne systems** ・**Pigment dispersants** ・**Dispersants for emulsions**	・Can be solubilized via neutralization in alkaline water
Alkoxysilyl Group-Containing Polymer	US-6000		・**Sealing compounds** for building exteriors ・Reactive plasticizers for various **plastics**	・Improved resistance to volatilization at high temperature ・Improved bleed resistance

Samples: 1kg

Application Examples

■ Sealing Compounds

● Purpose of Formulation
- To impart flexibility (plasticizer)
- To improve weatherability (prevent cracking and bleed-out)

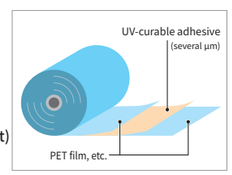
● Formulation Example

Component	Blend Ratio (wt%)
Base Polymer (Silicone, polysulfide polymer, etc.)	40 to 50
Filler (Silica, calcium carbonate, etc.)	30～40
Plasticizer (ARUFON) *Typically phthalate-based	10～30
Various Additives (Catalysts, antioxidants, etc.)	5～10

● Formulation Example

	ARUFON	Conventional Plasticizers (Dimethyl silicone, phthalates)
Staining from Plasticizer Bleed on Outdoor Exposure		
	High molecular weight and reactive nature make it resistant to bleeding and staining	Plasticizers and other components exude over time, attracting dust and causing staining

■ Film Lamination Adhesives

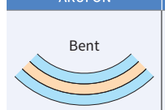


● Purpose of Formulation
- To impart flexibility (plasticizer)
- To improve adhesion (Prevent staining from bleed-out)

● Formulation Example

Component	Blend Ratio (wt%)
Photocurable Adhesive (Oligomer, Monomer)	80～90
Plasticizer (ARUFON)	10～20
Photoinitiator	3～5

● Comparison with Unplasticized and Conventionally Plasticized Adhesives

ARUFON	Without Plasticizer	With Conventional Plasticizer
		

4 IXE® Series

Inorganic Ion Scavenger

Intended Applications: Paints, Adhesives, Encapsulants

Grades

Three types are available: for cation, anion, and dual-ion capture.
Each type includes a lineup of several grades with different median particle sizes.

Type	Representative Grade	Median Diameter	Composition	Preferentially Captured Ions
Cation Capture	IXE-100	1μm	Zr-based (Zirconium)	Na^+,Cu^{2+}
Anion Capture	IXE-700F	1.5μm	Mg, Al-based	Cl^-,PO_4^{3-} (phosphate ion)
Dual-Ion Capture	IXEPLAS-A1	0.5μm	Zr, Mg, Al-based	Na^+,Cu^{2+},Cl^-

Samples: 100g

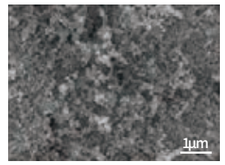
Application Examples

■ Inhibition of Copper Wiring Migration

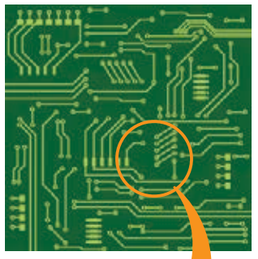
Test Conditions
- Epoxy acrylate + urethane acrylate resin formulated with 1% IXEPLAS-A1
- Line width 50μm, line spacing 50μm
- Biased HAST (85°C, 85%RH, 50V, 1000 hours)

Test Results

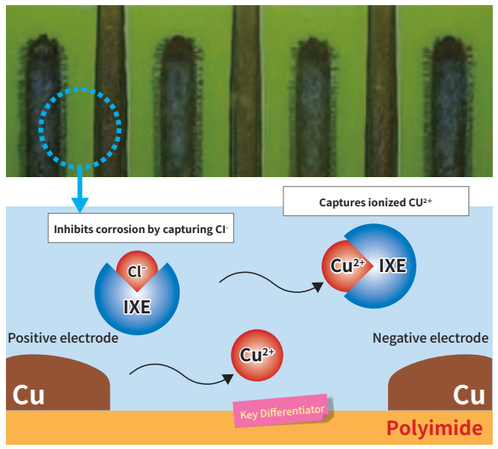
Formulating with IXEPLAS-A1 inhibits migration (the deposition of metal ions) on electronic circuit boards



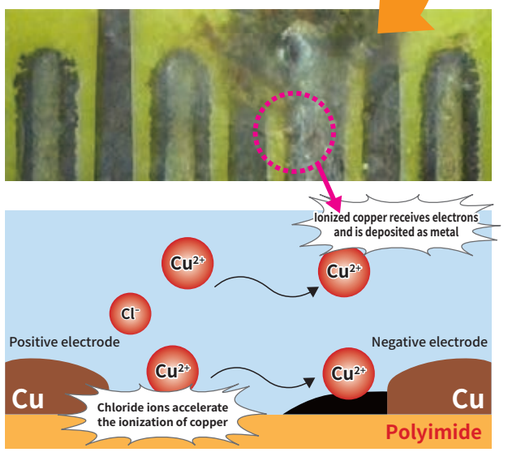
SEM Image of IXEPLAS-A1


Formulated in solder resist

IXEPLAS-A1 (1% formulation)

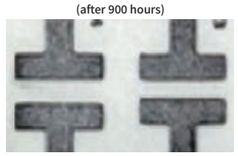


Without IXE

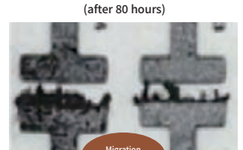


■ Silver Paste Migration Test

With 5% IXE300 (after 900 hours)



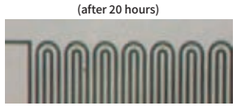
Without IXE (after 80 hours)



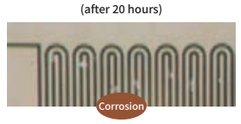
Test Conditions
- Silver paste baked at 850°C for 15 minutes
- 40°C, 95% humidity, 100V applied

■ Aluminum Wiring Corrosion Test

With 0.5 phr IXE-770D (after 20 hours)



Without additive (after 20 hours)



Test Conditions
- Bisphenol epoxy resin + amine-based curing agent (100 parts) IXE-770D (2 parts)
- Pressure Cooker Test
  1.0g of powdered resin / 20mL of deionized water, 121°C × 20 hours