

DOTITE

Electrically Conductive Inks for Printed Electronics



Electronics Materials Division

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FUJIKURA KASEI CO.,LTD.

Taking on Challenges and Working Together

Introduction and Business Divisions

Fujikura Kasei produces polymer materials for a variety of applications, developing unique, value-added products based on our decades of accumulated expertise.



Coatings for Plastics



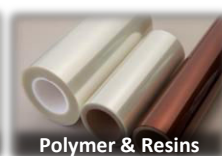
Architectural Coatings



Electronics Materials



Medical Materials



Polymer & Resins

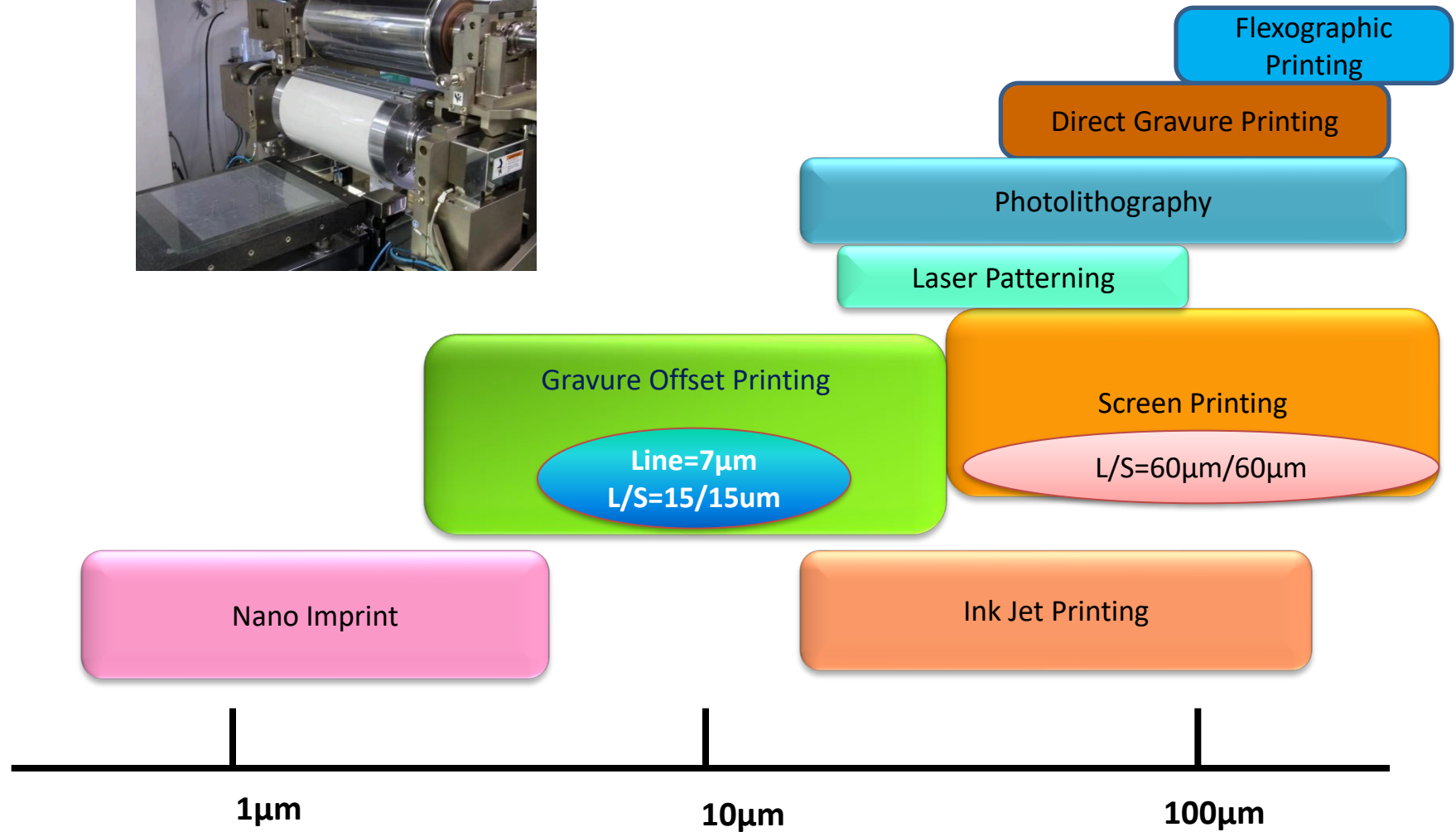
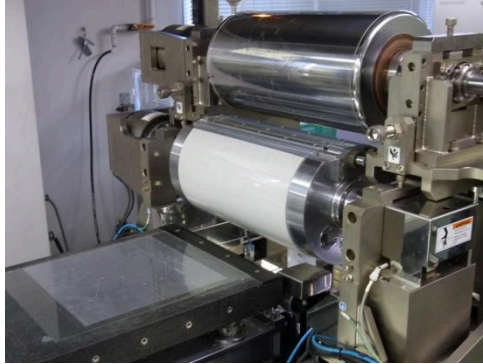
DOTITE Electrically Conductive Pastes

In 1957, we were the first manufacturer in Japan to develop and sell electrically conductive pastes and insulators for electronics under the brand name DOTITE. We have a wide range of inks, adhesives, and EMI shield paints.

This catalogue will introduce some of our current products and latest developments in conductive inks.



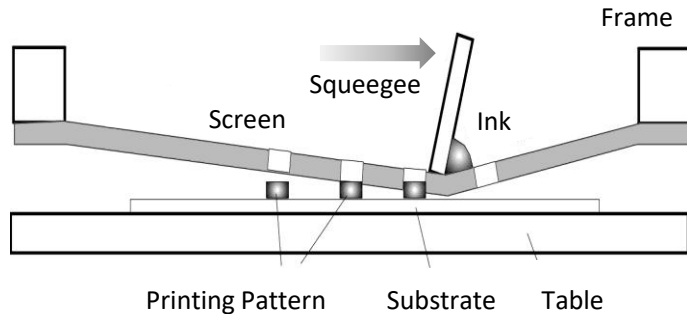
Introduction - PE Printing Methods and Line Width



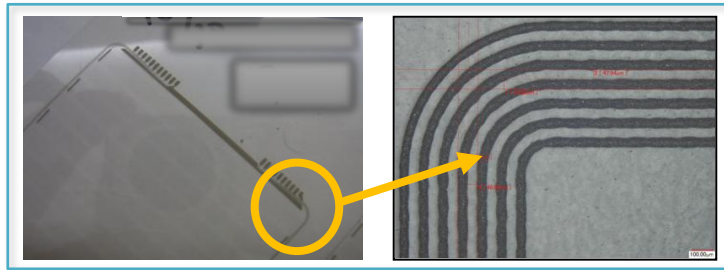
DOTITE – Fine Line Screen Printing

Fine line circuitry can be formed using screen printing.

Printing Process:



Use Case: Lead lines for touch panels (XA-3512)



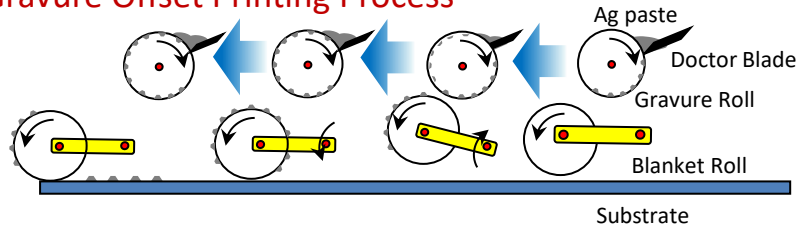
- Ultra fine filler and increased viscosity makes L/S: 100/100μm or lower possible.
- Widely used in touch panels for automotive and industrial touch panels and other applications.

	DOTITE FA-345	DOTITE XA-3512	DOTITE XA-4044
Resin	Polyester	Polyester	Polyester
Curing Conditions	150°C, 30 mins.	140°C 20 mins.	150°C, 30 mins.
Line Width (μm)	L/S: 100/100	L/S: 75/75	L/S: 30/30
Resistivity	$4.0 \times 10^{-5} \Omega \cdot \text{cm}$	$5.9 \times 10^{-5} \Omega \cdot \text{cm}$	$2.4 \times 10^{-5} \Omega \cdot \text{cm}$
Substrate	PET, glass	PET, glass, ITO	PET
Storage	Refrigerated, 4 mos.	Refrigerated, 6 mos.	Refrigerated, 4 mos. (prelim.)
Thinner	SC-0030	SC-0030	FS Thinner
Notes	High flexibility	For touch panels	High electrical conductivity

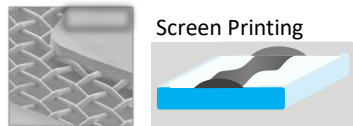
DOTITE – Ultra Fine Line Gravure Offset Printing

Ultra fine line circuitry can be formed using gravure offset printing.

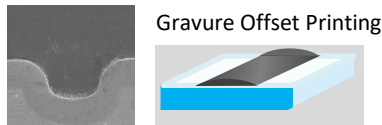
Gravure Offset Printing Process



- Screen printing results in irregular surface from the screen mesh.



- The engraved print pattern transfers the ink cleanly with fewer irregularities.



Use Case: Transparent conductive film (XA-3823)



- Effectively invisible, 7μm lines can form a transparent conductive film.

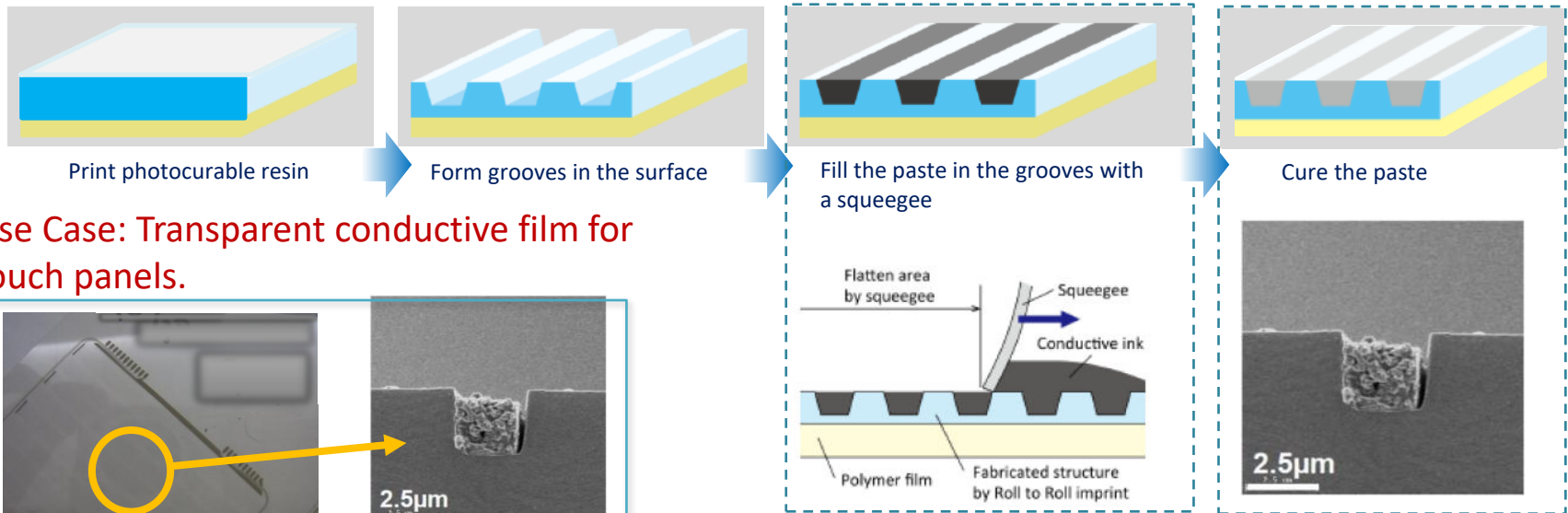
	DOTITE XA-3609	DOTITE XA-3823
Resin	Phenol	Phenol
Curing Conditions	130°C, 30 mins.	150°C 30 mins.
Line Width	L: 10-15μm	L: 7-10μm
Resistivity	3.0×10^{-5} $\Omega \cdot \text{cm}$	3.0×10^{-5} $\Omega \cdot \text{cm}$
Substrate	PET, glass	PET, glass
Storage	Frozen, 1 yr.	Frozen, 3 mos.
Thinner	SC-0024	SC-0024
Notes	Standard type	Printability, Low visibility

DOTITE – Ultra Fine Line Nano Imprinting

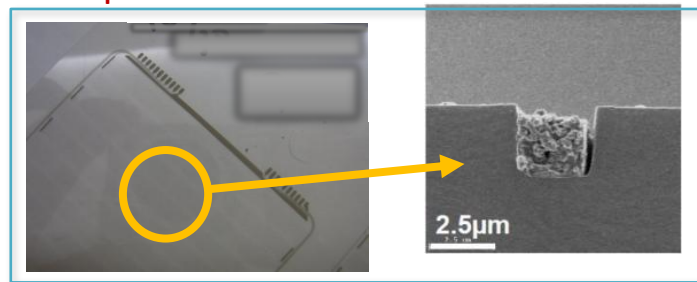
Ultra fine line printing can be achieved with nano imprinting.

	Resin	Curing Conditions	Line Width	Resistivity ($\Omega \cdot \text{cm}$)	Substrate	Storage	Thinner	Notes
DOTITE XA-3823	Phenol	150°C, 30 mins.	L: 2-3 μm	3.0×10^{-5}	PET, glass	Frozen, 3 mos.	SC-0024	Low visibility

Printing Process



Use Case: Transparent conductive film for touch panels.



- 2-3 μm line width for applications that require precise fine lines, such as smart phones.

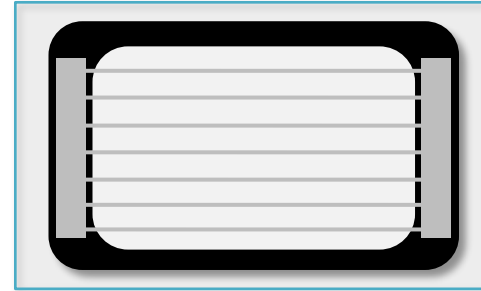
- The paste can't spread in the grooves, making ultra fine lines possible.
- Removing the paste from the non-line areas using the squeegee requires precision processing.

DOTITE – High Electrical Conductivity

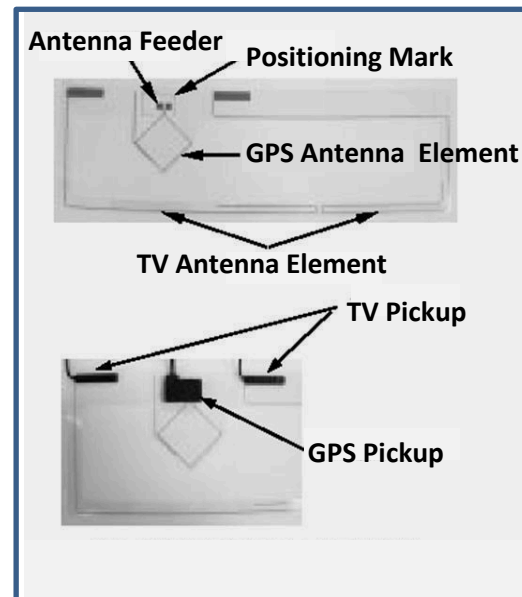
Polymer-based inks with improved formulation for high electrical conductivity.

	DOTITE FA-451A	DOTITE XA-3676	DOTITE XA-3851
Resin	Polyester	Polyester	Polyester
Curing Conditions	150°C, 30 mins.	125°C 60 mins.	80°C, 30 mins.
Resistivity	1.7×10^{-5} $\Omega \cdot \text{cm}$	2.0×10^{-5} $\Omega \cdot \text{cm}$	2.0×10^{-5} $\Omega \cdot \text{cm}$
Substrate	PET, glass	PET, PC	PET
Storage	Room temp., 4 mos.	Refrigerated, 4 mos.	Room temp., 4 mos.
Thinner	P Thinner	SC-0007	P Thinner
Notes	Standard high electrical conductivity type	For printing on PC substrate	Low temp. curing; can be pad printed

Use Case: Automotive defroster (XA-3676)



Use Case: Automotive film antenna (FA-451A)



- High electrical conductivity is possible through a careful formulation of silver filler and resin binder.
- Used widely in 5G antennas, IC tag antennas, and similar applications.

*Source:
FUJITSU TEN Technical Report

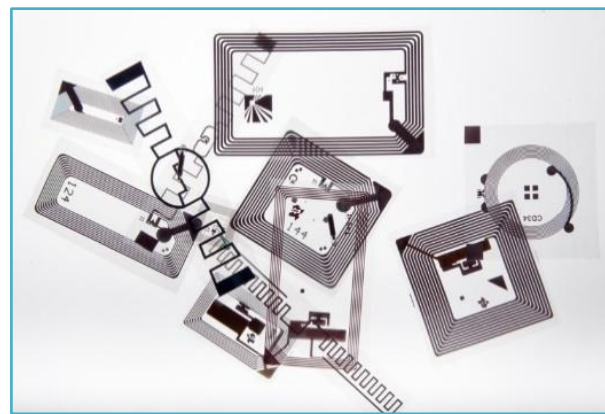
DOTITE – High Electrical Conductivity - Sintering

Highly conductive electrical circuits can be achieved with sintering metallic filler.

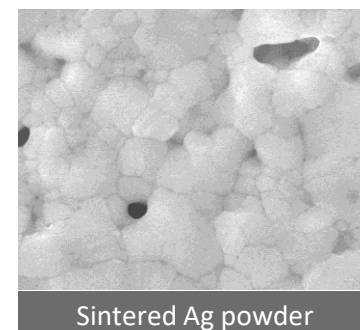
	DOTITE XA-9565	DOTITE XA-9508
Resin	None (Conductive filler only)	None (Conductive filler only)
Curing Conditions	130°C, 30 mins.	150°C 30 mins.
Resistivity	9.1×10^{-6} $\Omega \cdot \text{cm}$	6.0×10^{-6} $\Omega \cdot \text{cm}$
Substrate ※	PET, etc.	PET, etc.
Storage	Frozen, 4 mos.	Frozen, 4 mos.
Thinner	SC-0063	SC-0011
Notes	Low cost, High electrical conductivity	Thin film, High electrical conductivity

※Use of undercoat to improve adhesion is recommended

Use Case: RFID antenna



Regular flake Ag powder



Sintered Ag powder

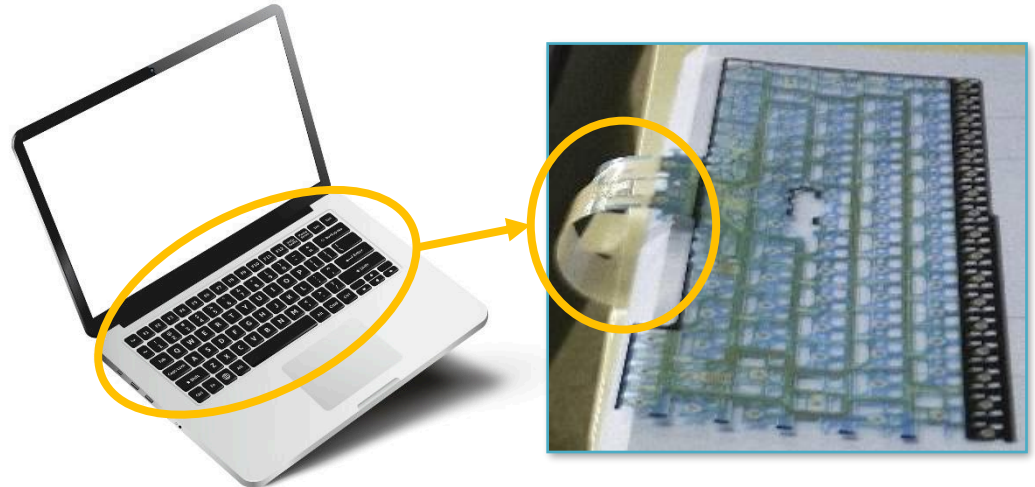
- Compared to regular Ag filler that conducts electricity through contact between particles, sintered Ag filler provides much higher electrical conductivity.
- Allows use of screen printing over more complex processing methods such as chemical etching which can reduce the number of production processes and improve efficiency.

DOTITE – High Flexibility Inks

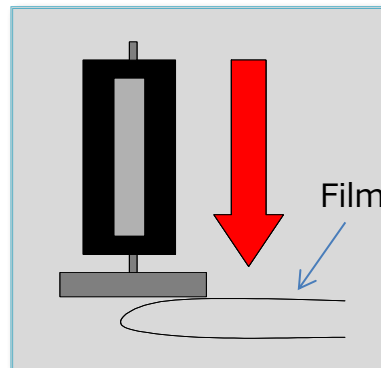
For flexible printed electronic circuitry that require high flexibility.

	DOTITE FA-353N	DOTITE XA-3836
Resin	Polyester	Polyester
Curing Conditions	150°C, 30 mins.	150°C 30 mins.
Resistivity	2.9×10^{-5} $\Omega \cdot \text{cm}$	1.5×10^{-5} $\Omega \cdot \text{cm}$
Substrate	PET, glass	PET
Storage	Room temp., 6 mos.	Room temp., 3 mos.
Thinner	P Thinner	P Thinner
Notes	180° bending, High flexibility	Flexible, Low resistivity

Use Case: Membrane switch for laptops (FA-353N)



- Widely used in membrane switch applications that require high flexibility.



Bending Test Conditions (FA-353N)

1 test cycle = Inward crease + Outward crease

180° inward crease (5kgf, 5 secs.)

+180° outward crease (5kgf, 5 secs.)

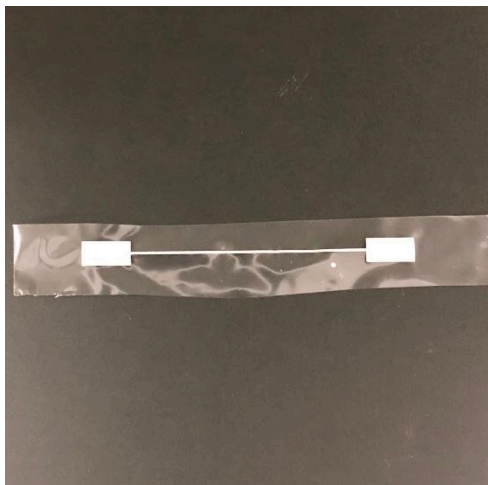
Durable for over 20 cycles

DOTITE – Water Soluble Type

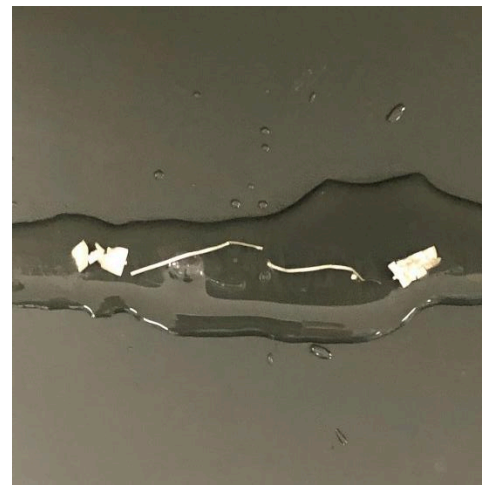
For forming films that dissolve in water.

	Curing Conditions	Resistivity	Substrate	Storage	Thinner	Notes
DOTITE XA-3880	120°C, 30 mins.	$1.0 \times 10^{-4} \Omega \cdot \text{cm}$	PVA	Room temp. 6 mos.	SC-0011	Printed film dissolves in water For water leak sensors

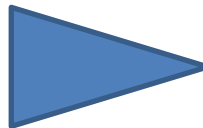
Before wetting



After wetting



After 5 secs.



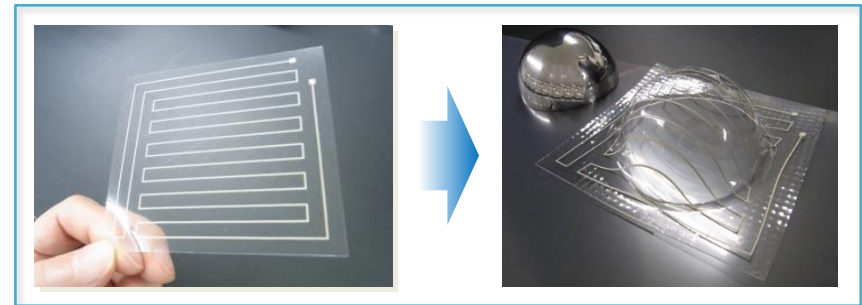
- Substrate: PVA
- Liquid Amt.: 1cc ● Circuit Pattern: 0.5mm x 50mm (width x length)
- Approximately 5 secs. after wetting, the circuit is broken.

DOTITE – Stretchable and Formable Inks

Stretchable and formable pastes with carbon filler and insulating variations are available.

	DOTITE XA-9521	DOTITE XA-9587	DOTITE XA-3737
Resin	Urethane	Silicone	Polyester
Curing Conditions	100°C, 60 mins.	160°C 60 mins.	125°C, 30 mins.
Resistivity	4.0×10^{-4} $\Omega \cdot \text{cm}$	2.0×10^{-4} $\Omega \cdot \text{cm}$	1.0×10^{-4} $\Omega \cdot \text{cm}$
Substrate	Urethane	Silicone	PET, PC
Notes	Standard urethane type, used in wearable applications	Standard silicone type	Usable on substrates like PC that are weak to solvent.

Use Case: Formable Circuitry (XA-3737)



Use Case: Mounting LEDs on Stretchable Paste



- Full lineup of stretchable and formable inks for printed electronics including conductive ink, carbon ink, adhesive, and insulating overcoat are available.
- A catalogue featuring our full lineup of stretchable and formable pastes is also available on request.

DOTITE — Additional Materials

	DOTITE XA-3513	DOTITE FA-333	DOTITE XA-3992	DOTITE XA-3993	DOTITE FC-415	DOTITE FC-435	DOTITE XB-3253	DOTITE XB-3364
Type	Ag/AgCl paste For medical devices ※	Standard Ag paste	Ag paste for FPC	Ag paste for metal plating	Carbon paste for protecting Ag circuits	Abrasion resistant carbon paste	High transparency resist	Transparent resist
Resin	Polyester	Polyester	Polyester	Polyester	Polyester	Phenol	Polyester	Polyester
Curing Conditions	150°C, 30 mins.	120°C, 10 mins.	150°C, 30 mins.	120°C, 30 mins.	150°C, 20 mins.	150°C, 30 mins.	150°C, 30 mins.	150°C, 30 mins.
Resistivity	1.0×10^{-4} $\Omega \cdot \text{cm}$	3.0×10^{-5} $\Omega \cdot \text{cm}$	4.5×10^{-5} $\Omega \cdot \text{cm}$	3.4×10^{-5} $\Omega \cdot \text{cm}$	2.0×10^{-1} $\Omega \cdot \text{cm}$	5.0×10^{-2} $\Omega \cdot \text{cm}$	-	-
Substrate	PET	PET, glass	PET, glass, PI	PET, glass	PET	PET, glass	PET	PET
Notes	Used in bioelectrodes for medical devices	Lower temp., Faster drying	Good adhesion to polyimide film	For electroplating or electroless plating	Widely used, standard type	High abrasion resistance	Environmental resistance, Good transparency	Semitransparent, Flexible Overcoat for FA-345

※Ag/AgCl ratio variations available



Taking on Challenges and Working Together