INDUSTRIAL SOLUTIONS

Enable electronics processing

Product selection guide

ELECPURE™

Technologies by

Catalogue

Dow and Dow Industrial Solutions overview

Semiconductor

- Photoresist
- Thinner
- Photoresist remover
  (Copper Corrosion, Stripping Performance)
- Wafer cutting fluid
  (Dispersion of Silicon Powder)
- Chemical mechanical planarization (CMP)

Display

- Photoresist
- Color resist
- Thinner
- Photoresist remover

PCB

- Copper Clad Laminate (CCL)
- Drilling & desmear
- Copper plating
- Photosensitive film
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- Developer
- Solder resist
- Solder ink
- Printed Circuit Board (PCB) cleaning / flux remover
- Offering overview by Printed Circuit Board (PCB) applications

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Dow and Dow Industrial Solutions overview

Dow (NYSE: DOW) combines one of the broadest technology sets in the industry with asset integration, focused innovation and global scale to achieve profitable growth and become the most innovative, customer centric, inclusive and sustainable materials science company. Dow's portfolio of performance materials, industrial intermediates and plastics businesses delivers a broad range of differentiated science-based products and solutions for our customers in high-growth segments, such as packaging, infrastructure and consumer care.

Dow Industrial Solutions delivers a complete portfolio of oxygenated solvents, specialty amines and other high-performance chemicals for electronics market. In just two decades, the technologies to make electronic devices have evolved rapidly, from desktop to laptop, from phone to smartphone, and from CRT TV to OLED TV. That evolution is only accelerating with each new generation of device with our increasingly productive and connected lifestyles. But these emerging technologies present new challenges for device makers – over and above the challenges they're already facing. Dow offers high purity, innovative ELECPURE™ solutions for semiconductor, display panel, printed circuit board and many other challenging uses across the industry's manufacturing processes. Many of our materials have been well recognized, and all of our efforts are informed by Dow's sustainability goals.

ELECPURE™

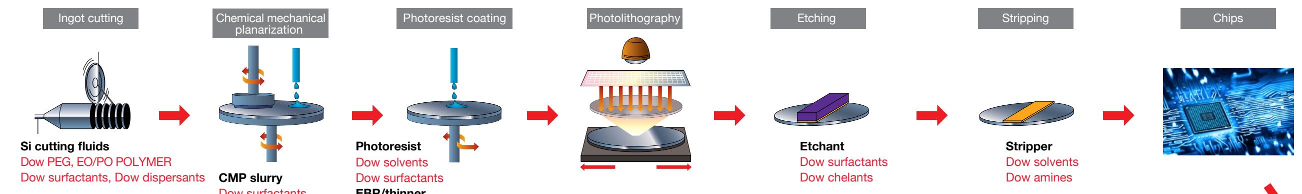
With the development of semiconductor and display technologies, electronics customers have more and more requirement on innovation, quality and supply excellence. Formulators and material manufacturers desire to work with suppliers who have good management on supply stability. Dow offers an expanded range of electronic grade products to formulators, enabled by a robust ELECPURE™ portfolio of high purity solution with ultra-low metal ion concentration.

Products for electronic applications

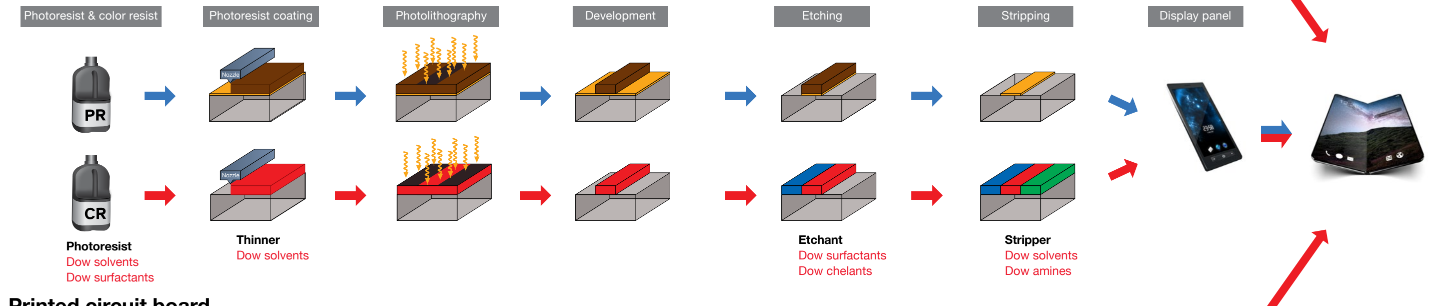
Amines	Solvents	Surfactants	Chelants	Polyglycols	Acylic polymer
• Alkalinity • Corrosion • Inhibition • Photoresist removal • Circuit board cleaning	• Photoresist • Color resist • Thinner • Resist removal • Hardener/resin solubilization • Circuit board cleaning	• Wetting • Good rinsing • Low foam • Cutting fluids • CMP • Etchant • Copper plating • Circuit board cleaning	Forming soluble complex with certain metal ions, inactivating the ions and copper plating	• Excellent thermal stability • High flash and fire points • Low foaming tendency • Viscosity adjustors • Good water solubility	Water soluble copolymer used to disperse inorganic fine particles in wafer cutting process
• MEA, DEA • MIPA • NMEA, MDEA • AEEA • EDA, DETA	• DOWANOL™ P-series Glycol Ethers • CARBITOL™ E-series Glycol Ethers • UCAR™ Ester EEP	• TRITON™, TERGITOL™, ECOSURF™ • DOWFAX™ Nonionic • TRITON™ DOWFAX™ Anionic	• VERSENE™ • VERSENEX™ • VERSENOL™	• UCON™ Lubricants • CARBOWAX™ PEGs	• ACUMER™ Copolymers

Dow Industrial Solutions offering in electronic processing

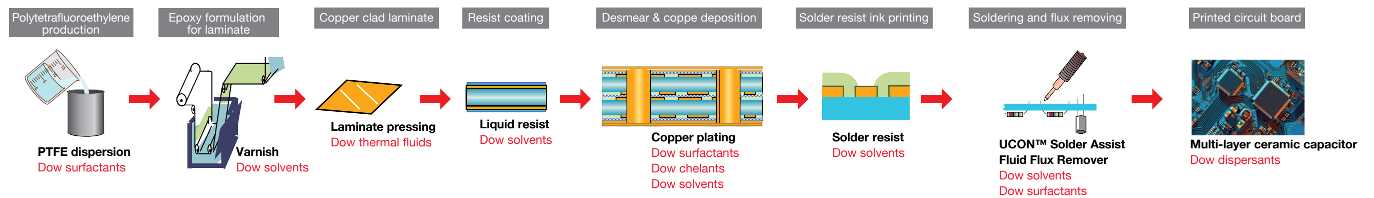
Semiconductor



Display



Printed circuit board



Semiconductor

Semiconductors are used for wide range of application in our daily life such as PCs, smartphones, automotives and home appliances. Semiconductor industry, a field with rapid growth, innovation and development, uses a broad range of highly sophisticated specialty chemicals in many processing steps in the manufacture of wafers and integrated circuits. Dow Industrial Solutions combines the power of different product portfolios including amines, solvents, surfactants, and provide customized products enabling broad selection of processing ancillaries, with ultra-low metal concentration, high purity and consistent quality. With our dedicated material for semiconductor, it enables ultra-fine processing technology and less failure. Dow will also support you for customized material for specific usage and technical problems.

Photoresists

Our oxygenated solvents used as media of photoresist formulation. Dow covers whole value chain of photoresist starting from polymer synthesis to formulating, We have materials for cutting-edge processing technology such as ArF and EUV.

Solvent	Chemical nomenclature	Boiling point (°C @ 760 mm Hg)	Evaporation rate (nBuAc= 1)	Surface tension (mN/m, @20°C)	Viscosity (cP@ 25°C)
DOWANOL™ PMA Glycol Ether Acetate	Propylene Glycol Methyl Ether Acetate	146	0.33	28.9	1.1
UCAR™ Ester EEP	Ethyl 3-ethoxypropionate	170	0.12	28.1	1.3
DOWANOL™ PM Glycol Ether	Propylene Glycol Methyl Ether	120	0.62	27.7	1.7

Thinners

Oxygenated solvents used to reduce the viscosity of photoresist, remove edge beads and improve the evenness of coated photoresist film on wafers. Our product also helps you to improve performance, reduce failure by highly purified solvents.

Solvent	Chemical nomenclature	Boiling point (°C @ 760 mm Hg)	Evaporation rate (nBuAc= 1)	Surface tension (mN/m, @20°C)	Viscosity (cP@ 25°C)
DOWANOL™ PM Glycol Ether	Propylene Glycol Methyl Ether	120	0.62	27.7	1.7
DOWANOL™ PMA Glycol Ether Acetate	Propylene Glycol Methyl Ether Acetate	146	0.33	28.9	1.1
UCAR™ Ester EEP	Ethyl 3-ethoxypropionate	170	0.12	28.1	1.3

Photoresist removers

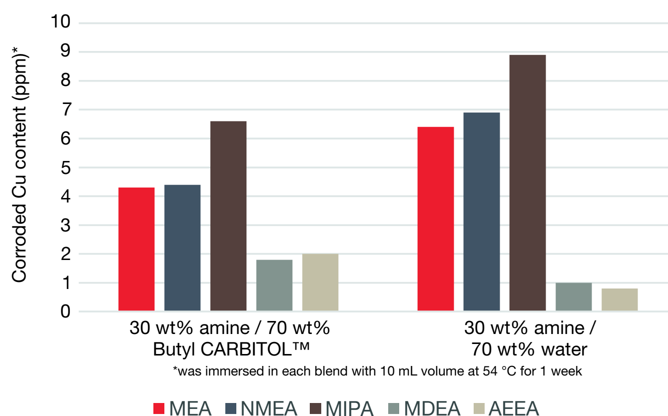
Oxygenated solvents and organic amines are key ingredients of photoresist stripping formulations which provide excellent solubility of photoresist. Our product can achieve quick dissolution without residue and less damage to substrate.

Solvent	Chemical nomenclature	Boiling point (°C @ 760 mm Hg)	Flash point (°C)	Solubility at water (wt% @ 20°C)
Methyl CARBITOL™	Diethylene Glycol Methyl Ether	194	92	∞
CARBITOL™ Solvent	Diethylene Glycol Ethyl Ether	202	96	∞
Butyl CARBITOL™	Diethylene Glycol Ethyl Ether	230	99	∞
DOWANOL™ DPM Glycol Ether	Dipropylene Glycol Methyl Ether	190	75	∞
Amine	**Chemical nomenclature**	**Boiling point (°C @ 760 mm Hg)**	**Flash point (°C)**	**Solubility at water (wt% @ 20°C)**
MEA	Monoethanolamine	171	96	∞
MIPA	Monoisopropanolamine	159	73	∞
MDEA	N-Methyldiethanolamine	247	138	∞
NMEA	N-Methylethanolamine	160	73	∞
AEEA	Aminoethylethanolamine	243	127	∞

Copper corrosion

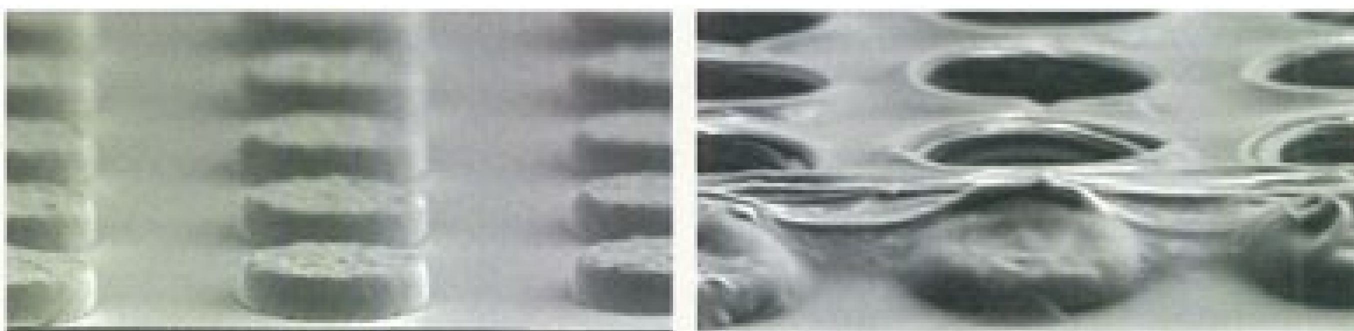
MEA, NMEA and MIPA are widely used in photoresist stripping formulations and act as key component to dissolve polymers. In the meanwhile, these organic amines bring metal corrosion performance. In comparison, MDEA and AEEA enable better metal patterns after lithography with their moderate metal corrosion performance.

Test method: determine Cu concentration in blends of amine/ Butyl CARBITOL™ or amine/water after a 10 mm × 10 mm × 1 mm copper plate (6N) was immersed in each blend at 54 oC for 1 week.



Stripping performance

A well developed stripping formulation can completely remove photoresist and residue, keep clean substrate pattern without serious corrosion or damages. The left picture demonstrates a good substrate pattern after photoresist stripping by formulation containing chemicals as Dow offers. The example in right picture is a failure by using improper solvent or amine.



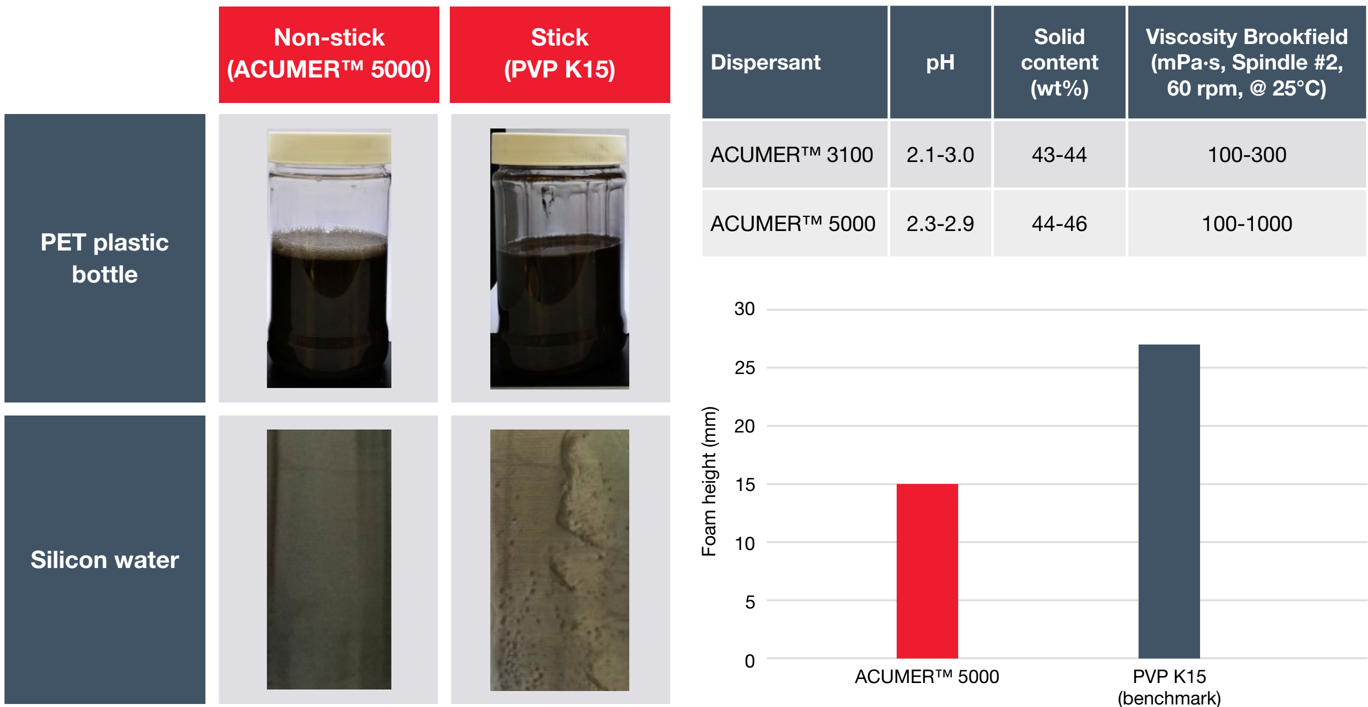
Wafer cutting fluid

To carve out wafer from crystalline ingot with appropriate angle and thinness, wire-saw cutting technology is adopted where fluid with abrasive grain is supplied between materials and wires that reciprocates at high speed. The surfactants are fundamental ingredients of both water-based or slurry-based fluids and can provide lubricity, cooling, cleaning, wetting properties to cutting process.

Nonionic surfactant	Cloud point (°C, 1 wt%)	HLB	CMC (ppm)/Surface tension (1 wt%, mN/m, @ 25°C)	Foam height (mm, 0.1 wt%, @ 25°C, Ross-Miles, initial/5min)
TERGITOL™ 15-S-7	37	12.1	38/30	117/28
TERGITOL™ 15-S-9	60	13.3	52/30	124/43
TERGITOL™ TMN-6	36	13.1	800/27	130/22
TRITON™ HW-1000	Dispersive	10.8	Insoluble	Insoluble
ECOSURF™ EH-6	40	10.8	914/30	20/0
ECOSURF™ LF-30	30	11.0	26/30	60/5

Dispersion of silicon powder

Considerable amount of fine silicon powders are produced during wafer cutting process. Sometimes a tiny particle is regarded as a defect remained at wafer surface. Fine powder also enables strengthened bubble wall and slow foam collapse. A fluid with good dispersion capability can prevent powder stuck onto hard surfaces with less foam generation.



Dispersant	pH	Solid content (wt%)	Viscosity Brookfield (mPa·s, Spindle #2, 60 rpm, @ 25°C)
ACUMER™ 3100	2.1-3.0	43-44	100-300
ACUMER™ 5000	2.3-2.9	44-46	100-1000

Benchmark is polyvinylpyrrolidone (PVP) K15. The tests were conducted by using 0.1 wt% aqueous solution with additional 8.0 wt.% silicon powder. The initial foam height of ACUMER™ aqueous solution is lower.

Chemical mechanical planarization (CMP)

CMP is a polishing process assisted by chemical reactions to remove surface materials. It is referred to both polishing process and planarization process and considered to be a tribochemical process because of the synergy between friction and corrosion. The supplied amines can provide material corrosion performance and surfactants assist to provide smooth polishing process with excellent surface wetting.

Amine	Chemical nomenclature	Boiling point (°C @ 760 mm Hg)	Vapor pressure (mm Hg @ 20°C)	Feature
MEA	Monoethanolamine	171	0.050	Primary amine
MIPA	Monoisopropanolamine	159	0.053	Primary amine
EDA	Ethylenediamine	207	0.021	Primary diamine

Nonionic surfactant	Cloud point (°C, 1 wt%)	HLB	CMC (ppm)/Surface tension (1 wt%, mN/m, @ 25°C)	Foam height (mm, 0.1 wt%, @ 25°C, Ross-Miles, initial/5 min)
TERGITOL™ 15-S-7	37	12.1	38/30	117/28
TERGITOL™ 15-S-9	60	13.3	52/30	124/43
TERGITOL™ TMN-6	36	13.1	800/27	130/22
TERGITOL™ TMN-10	76	14.4	1313/30	118/28
ECOSURF™ EH-6	40	10.8	914/30	20/0
ECOSURF™ EH-9	61	12.5	1066/31	60/0
ECOSURF™ LF-30	30	11.0	26/30	60/5
ECOSURF™ LFE-635	35	9.5-10.5	315/32	0/0

Display

From PCs and appliances to watches and smartphones, electronic display screens help us stay connected to the world and each other in countless ways. Display industry also uses a broad range of performance specialty chemicals in fabrication of panels, similar as in semiconductor industry. Dow Industrial Solutions works closely with our customers, providing amines and solvents with low metal impurities, high purity and consistent quality, to make displays more reliable and readable with faster responsive. We also provide customized products according to customer requirements to enable the broad selection of processing ancillaries, and strive to support them through the whole value chain to enable the high efficiency and high quality production.

Photoresists

Oxygenated solvents used as media of photoresist synthesis.

Solvent	Chemical nomenclature	Boiling point (°C @ 760 mm Hg)	Evaporation rate (nBuAc= 1)	Surface tension (mN/m, @20°C)	Viscosity (cP@ 25°C)
DOWANOL™ PM Glycol Ether	Propylene Glycol Methyl Ether	120	0.62	27.7	1.7
DOWANOL™ PMA Glycol Ether Acetate	Propylene Glycol Methyl Ether Acetate	146	0.33	28.9	1.1
UCAR™ Ester EEP	Ethyl 3-ethoxypropionate	170	0.12	28.1	1.3

Color resists

Oxygenated solvents used as media of color resist formulation and maintain pure color of each resist. Dow covers whole value chain of photoresist starting from polymer and binder synthesis to formulating.

Solvent	Chemical nomenclature	Boiling point (°C @ 760 mm Hg)	Evaporation rate (nBuAc= 1)	Surface tension (mN/m, @20°C)	Viscosity (cP@ 25°C)
DOWANOL™ PM Glycol Ether	Propylene Glycol Methyl Ether	120	0.62	27.7	1.7
DOWANOL™ PMA Glycol Ether Acetate	Propylene Glycol Methyl Ether Acetate	146	0.33	28.9	1.1
UCAR™ Ester EEP	Ethyl 3-ethoxypropionate	170	0.12	28.1	1.3

Thinners

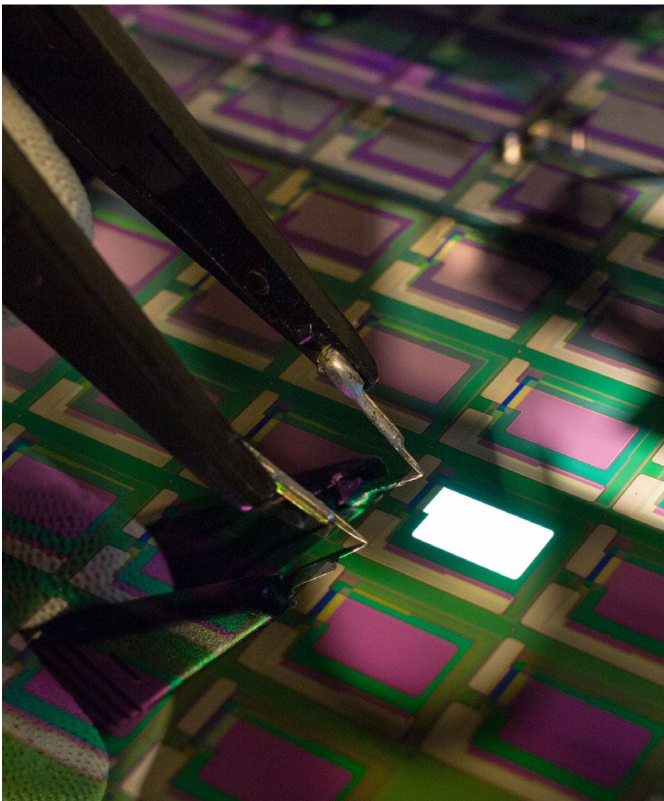
Oxygenated solvents used to reduce the viscosity of photoresist, remove edge beads and improve the evenness of coated photoresist film or color resist film.

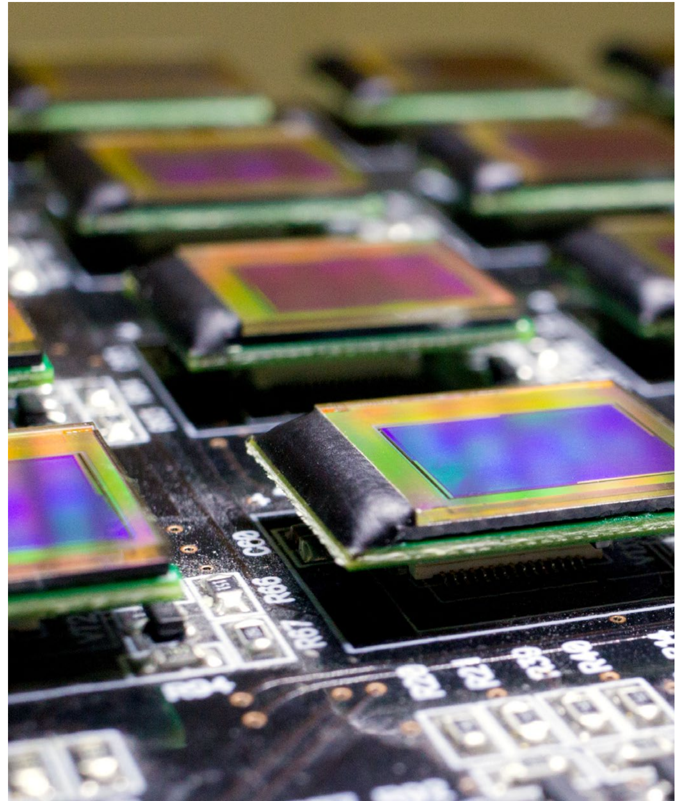
Solvent	Chemical nomenclature	Boiling point (°C @ 760 mm Hg)	Evaporation rate (nBuAc= 1)	Surface tension (mN/m, @20°C)	Viscosity (cP@ 25°C)
DOWANOL™ PMA Glycol Ether Acetate	Propylene Glycol Methyl Ether Acetate	146	0.33	28.9	1.1
UCAR™ Ester EEP	Ethyl 3-ethoxypropionate	170	0.12	28.1	1.3
DOWANOL™ PM Glycol Ether	Propylene Glycol Methyl Ether	120	0.62	27.7	1.7
DOWANOL™ PGDA	Propylene Glycol Diacetate	191	0.039	32.5	2.6
DOWANOL™ DPM Glycol Ether	Dipropylene Glycol Methyl Ether	190	0.035	28.8	3.7
Methyl CARBITOL™	Diethylene Glycol Methyl Ether	194	0.019	32.5	3.5
CARBITOL™ Solvent	Diethylene Glycol Ethyl Ether	202	0.013	31.8	3.6

Photoresist removers

Oxygenated solvents and organic amines are key ingredients of photoresist stripping formulations which provide excellent solubility of photoresist.

Solvent	Chemical nomenclature	Boiling point (°C @ 760 mm Hg)	Flash point (°C)	Solubility at water (wt% @ 20°C)
Methyl CARBITOL™	Diethylene Glycol Methyl Ether	194	92	∞
CARBITOL™ Solvent	Diethylene Glycol Ethyl Ether	202	96	∞
Butyl CARBITOL™	Diethylene Glycol Ethyl Ether	230	99	∞
DOWANOL™ DPM Glycol Ether	Dipropylene Glycol Methyl Ether	190	75	∞
Amine	**Chemical nomenclature**	**Boiling point (°C @ 760 mm Hg)**	**Flash point (°C)**	**Solubility at water (wt% @ 20°C)**
MEA	Monoethanolamine	171	96	∞
MIPA	Monoisopropanolamine	159	73	∞
MDEA	N-Methyldiethanolamine	247	138	∞
NMEA	N-Methylethanolamine	160	73	∞
AEEA	Aminoethylethanolamine	243	127	∞





Printed Circuit Board (PCB)

Dow offers a wide range of available chemistries, extensive applications expertise, a global technical support network and stable product supply. These solutions are used for copper plate laminating, drilling, plating, cleaning, etc. for printed circuit boards (PCBs), which allows smooth and rapid processing of your products.

Copper clad laminate

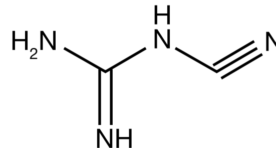
A copper clad laminate is a type of product through lamination with copper clad on either one side or both sides of reinforcing material after being soaked in resin varnish. The resin varnish is prepared by dissolving a dry resin in solvents with proper evaporate ranges, and dispersing fillers in the solution with the assistance of surfactants.

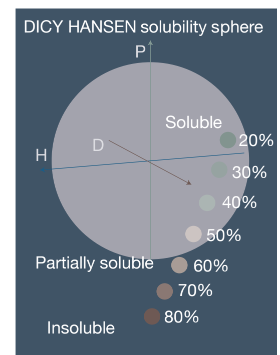
Solvent	Chemical nomenclature	Boiling point (°C @ 760 mm Hg)	Evaporation rate (nBuAc= 1)	Resin types
DOWANOL™ PM Glycol Ether	Propylene Glycol Methyl Ether	120	0.62	Epoxy, cyanate, bismaleimide-triazine (BT)
DOWANOL™ PnP Glycol Ether	Propylene Glycol Propyl Ether	149	0.21	
DOWANOL™ PnB Glycol Ether	Propylene Glycol Butyl Ether	171	0.093	
DOWANOL™ PMA Glycol Ether Acetate	Propylene Glycol Methyl Ether Acetate	146	0.33	

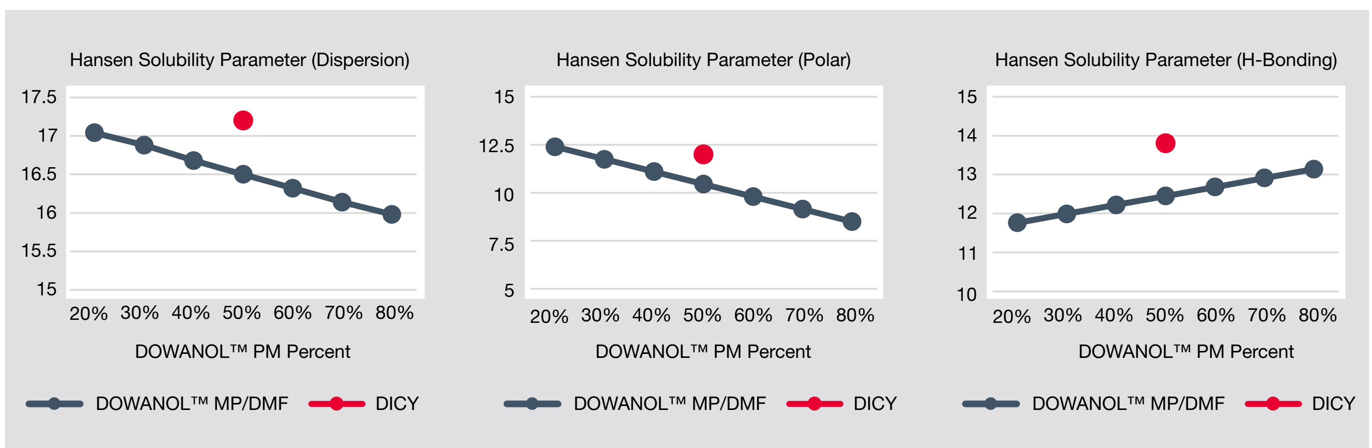
Nonionic surfactant	Cloud point (°C, 1 wt%)	HLB	CMC (ppm)/Surface tension (1 wt%, mN/m, @ 25°C)	Foam height (mm, 0.1 wt%, @ 25°C, Ross-Miles, initial/5 min)	Resin types
TRITON™ X-100	66	13.4	189/33	128/107	Epoxy, PTFE
TERGITOL™ 15-S-9	60	13.3	52/30	124/43	Epoxy
TERGITOL™ TMN-3	Insoluble	8.1	Insoluble	Insoluble	PTFE
TERGITOL™ TMN-6	36	13.1	800/27	130/22	Epoxy, PTFE

Dicyandiamide (DICY) dissolution

DICY is one of the most common hardeners used in epoxy type copper clad laminates. The conventional solvents for DICY dissolution are N,N-dimethyl formamide and ethylene glycol methyl ether. In order to reduce the usage of such hazardous chemicals, a blend containing DOWANOL™ PM is recommended as a sustainable solution with less environmental impact.







Close Hansen solubility parameters of solute and solvent usually represent that this solute can be dissolved in solvent well.

Hot pressing

Heat transfer fluid is used in hot press machine in PCB production process. Heating temperatures varies from PCB type. Heating temperatures varies from PCB type. 360-390 °C heating temperature is used for 5G and automotive radar PCB hot press process. both SYLTHERM™ 800 and DOWTHERM™ A can be offered to meet the extremely high working temperature. But SYLTHERM™ 800 can provide superior performance in terms of long life without degradation. DOWTHERM™ T is offered for the conventional PCB hot press process where the heating temperature is from 240 to 280°C.

Attribute	SYLTHERM™ 800	DOWTHERM™ A	DOWTHERM™ T
Fluid type	Silicon fluid	Synthetic organic	Synthetic organic
Working temperature, °C	-40-400	12-400	-15-315
Density at 25°C, kg/m³	93	1056	869.8
Flash point, closed cup, °C	160	113	188
Freezing Point, °C	-60	12	-40
Auto ignition temperature, °C	385	599	375

Drilling and desmear

Formulation containing solvents, amines and surfactants enables outstanding cleaning and roughening performance for bare laminates utilized in high-end integrated circuit substrates.

Solvent	Chemical nomenclature	Boiling point (°C @ 760 mm Hg)	Flash point (°C)	Vapor pressure (mm Hg @ 20°C)
DOWANOL™ EPh Glycol Ether	Ethylene Glycol Phenyl Ether	244	121	0.0004
DOWANOL™ TPnB Glycol Ether	Tripropylene Glycol Butyl Ether	274	126	0.002
Butyl CARBITOL™	Diethylene Glycol Butyl Ether	230	99	0.09
Amine	**Chemical nomenclature**	**Boiling point (°C @ 760 mm Hg)**	**Flash point (°C)**	**Vapor pressure (mm Hg @ 20°C)**
MEA	Monoethanolamine	171	96	0.05
MIPA	Monoisopropanolamine	159	73	0.053
DETA	Diethylenetriamine	207	98	0.08

Nonionic surfactant	Cloud point (°C, 1 wt%)	HLB	CMC (ppm)/Surface tension (1 wt%, mN/m, @ 25°C)	Foam height (mm, 0.1 wt%, @ 25°C, Ross-Miles, inital/5 min)
TRITON™ HW-1000	Dispersive	10.8	Insoluble	Insoluble
TRITON™ RW-150	> 100	> 16	860/30 pH=12 —/54 pH=2	135/15 pH=12
TERGITOL™ XD	74	No data	—/38	60/25
TERGITOL™ 15-S-9	60	13.3	52/30	124/43
TERGITOL™ TMN-6	36	13.1	800/27	130/22
DOWFAX™ DF-103	22	—	—/—	1/0
DOWFAX™ 100N15	17	—	—/32.6	0/0

Copper plating

Plating reagent is a highly comprehensive liquid system with many chemicals including surfactants, fluids and polyglycols, and chelants which can effectively proceed metallization for printed circuit boards and exotic dielectric materials.

Nonionic surfactant	Cloud point (°C, 1 wt%)	HLB	CMC (ppm)/Surface tension (1 wt%, mN/m, @ 25°C)	Foam height (mm, 0.1 wt%, @ 25°C, Ross-Miles, initial/5 min)
TERGITOL™ XD	74	—	—/38	60/25
TERGITOL™ 15-S-9	60	13.3	52/30	124/43
TERGITOL™ TMN-6	36	13.1	800/27	130/22
DOWFAX™ 100N15	17	—	—/32.6	0/0
ECOSURF™ LF-30	30	11.0	26/30	60/5
ECOSURF™ LF-45	45	12.0	28/32	120/10
ECOSURF™ LFE-635	35	9.5-10.5	315/32	0/0
Anionic surfactant	**Active content (wt%)**	**Solvent**	**Surface tension (1 wt%, mN/m, @ 25°C)**	**Foam height (mm, 0.1 wt%, @ 25°C, Ross-Miles, initial/5 min)**
TRITON™ GR-5M	60	IPA / water	26 pH=7	190/180 pH=7
TRITON™ QS-44	80	Water	38 pH=7 39 pH=12.5	130/65 pH=7 150/140 pH=12.5
DOWFAX™ 2A1	45	Water	34 pH=7 35 pH=12.5	140/130 pH=7 145/145 pH=12.5

Fluids and polyglycol	Viscosity (cSt @ 100°C)	Solubility at Water (wt% @ 20 °C)	Average Molecular Weight
UCON™ 50-HB-260	11.1	∞	870
CARBOWAX™ PEG 200	4.3	∞	190-210

Chelants	Chemical nomenclature	Chelation Value (mg as $CaCO_3$ per g)	Assay %	pH (1 wt.% aqueous solution)
VERSENE™ 100	Tetrasodium ethylenediaminetetraacetate	102	39 wt% Na_4EDTA	11.0-11.8
VERSENE™ Diammonium EDTA	Diammonium ethylenediaminetetraacetate	137	45 wt% $(NH_4)_2EDTA$	4.6-5.3
VERSENE™ 220 Crystals	Tetrasodium ethylenediaminetetraacetate tetrahydrate	219	99 wt% $Na_4EDTA \cdot 4H_2O$	10.5-11.5
VERSENEX™ 80	Pentasodiumdiethylenetriaminepentaacetate	80	40.2 wt% Na_5DTPA	11.0-11.8
VERSENOL™ 120	Trisodium N-(hydroxyethyl)-ethylenediaminetriacetate	120	41 wt% Na_3HEDTA	11.0-11.8

Photosensitive film

Oxygenated solvents are good selections of media which enables synthesis and dissolution of resin for photosensitive film. They can be both applied in dry film type and liquid type film with good solvency and suitable evaporate ranges.

Solvent	Chemical nomenclature	Boiling point (°C @ 760 mm Hg)	Flash point (°C)	Evaporation rate (nBuAc= 1)
DOWANOL™ DPM Glycol Ether	Dipropylene Glycol Methyl Ether	190	75	0.035
DOWANOL™ PMA Glycol Ether Acetate	Propylene Glycol Methyl Ether Acetate	146	42	0.33

Photosensitive film stripping

Oxygenated solvents, amines and surfactants are key ingredients of photosensitive resin stripping formulations which provide excellent solvency and cleaning performance.

Solvent	Chemical nomenclature	Boiling point (°C @ 760 mm Hg)	Flash point (°C)	Solubility at water (wt% @ 20°C)
Butyl CELLOSOLVE™	Ethylene Glycol Butyl Ether	171	65	∞
Butyl CARBITOL™	Diethylene Glycol Butyl Ether	230	99	∞
Amine	**Chemical nomenclature**	**Boiling point (°C @ 760 mm Hg)**	**Flash point (°C)**	**Solubility at water (wt% @ 20°C)**
MEA	Monoethanolamine	171	96	∞
DEA	Diethanolamine	270	191	∞

Nonionic surfactant	Cloud point (°C, 1 wt%)	HLB	CMC (ppm)/Surface tension (1 wt%, mN/m, @ 25°C, initial/5 min)
TRITON™ X-100	66	13.4	189/33
TRITON™ CF-21	40	12.9	130/32
TRITON™ CF-32	25	11.0	—/37

Developer

Surfactants provide the desired wetting performance of developer solutions for patterning of etching resist. The recommended surfactants show good stability in alkaline solution.

Nonionic surfactant	Cloud point (°C, 1 wt%)	HLB	CMC/Surface tension (1 wt%, mN/m, @ 25°C)
TRITON™ X-100	66	13.4	189/33
TRITON™ CF-21	40	12.9	130/32
TRITON™ CF-32	25	11.0	—/37

Solder resist

Oxygenated solvents are good selections of media which enables synthesis and dissolution of solder resist with suitable evaporate ranges.

Solvent	Chemical nomenclature	Boiling point (°C @ 760 mm Hg)	Flash point (°C)	Evaporation rate (nBuAc= 1)
DOWANOL™ DPM Glycol Ether	Dipropylene Glycol Methyl Ether	190	75	0.035
DOWANOL™ PMA Glycol Ether Acetate	Propylene Glycol Methyl Ether Acetate	146	42	0.33

Solder ink

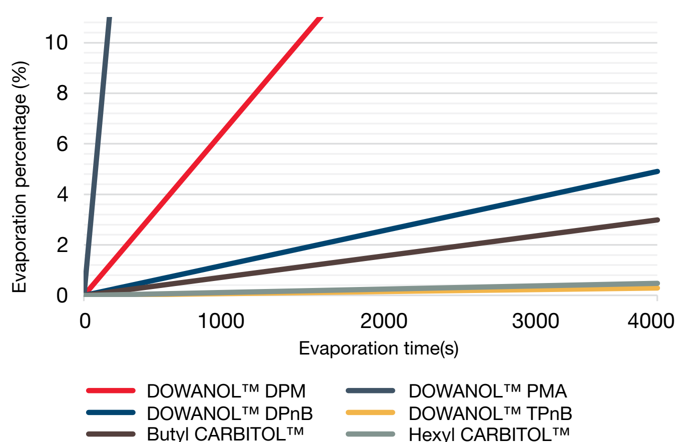
High temperature stable oxygenated solvents and fluids are major components used in solder ink formulations. With adjustable concentration of each component, the solder ink can perfectly match the high temperature processing conditions when assemble electronic elements onto printed circuit boards.

Solvent	Chemical nomenclature	Boiling point (°C @ 760 mm Hg)	Flash point (°C)	Evaporation rate (nBuAc= 1)
DOWANOL™ DPnB	Dipropylene Glycol Butyl Ether	230	100	0.006
DOWANOL™ TPnB	Tripropylene Glycol Butyl Ether	274	126	0.0004
Butyl CARBITOL™	Diethylene Glycol Butyl Ether	230	99	0.004
Hexyl CARBITOL™	Diethylene Glycol Hexyl Ether	259	135	0.0006

Fluid	Viscosity (cSt @ 100°C)	Solubility at water (wt% @ 20°C)	Average molecular weight
UCON™ 50-HB-260	11.1	∞	970
UCON™ 50-HB-400	16.3	∞	1,230
UCON™ 50-HB-660	25.6	∞	1,590
CARBOWAX™ PEG 600	10.8	∞	570-630

Evaporation curves of solvents

The evaporation percent against evaporation time at ambient temperature and humidity can be a good reference that helps screen solvent candidates and match appropriate high temperature processing conditions.



PCB cleaning / Flux removers

A broad chemical offerings are recommended for PCB cleaning / flux remover formulations no matter they are used in benchtop cleaning, batch immersion cleaning, vapor degreasing, or spray cleaning. The synergy among solvents, amines and surfactants enables outstanding performance of removing soils, dusts, flux, and other contaminants

Solvent	Chemical nomenclature	Boiling point (°C @ 760 mm Hg)	Flash point (°C)	Solubility at water (wt% @ 20°C)	Hansen solubility parameters (joules/cm^3)$^{1/2}$		
					Dispersion	Polar	H-bonding
DOWANOL™ EPh Glycol Ether	Ethylene Glycol Phenyl Ether	244	121	2.5	17.8	5.7	14.3
DOWANOL™ PPh Glycol Ether	Propylene Glycol Phenyl Ether	243	119	1.0	17.4	5.3	11.5
DOWANOL™ DPM Glycol Ether	Dipropylene Glycol Methyl Ether	190	75	∞	15.5	4.0	10.3
DOWANOL™ DPnB Glycol Ether	Tripropylene Glycol Propyl Ether	230	100	4.5	14.8	2.5	8.7
DOWANOL™ TPnB Glycol Ether	Tripropylene Glycol Butyl Ether	274	126	4.5	14.8	1.7	7.9
Butyl CARBITOL™	Diethylene Glycol Butyl Ether	230	99	∞	16.0	7.0	10.6
Hexyl CARBITOL™	Diethylene Glycol Hexyl Ether	259	135	2.0	16.0	6.0	10.0

Amine	Chemical nomenclature	Boiling point (°C @ 760 mm Hg)	Flash point (°C)	Solubility at water (wt% @ 20°C)
MEA	Monoethanolamine	171	96	∞
DEA	Diethanolamine	270	191	∞
MIPA	Monoisopropanolamine	159	73	∞

Nonionic surfactant	Cloud point (°C, 1 wt%)	HLB	CMC (ppm)/Surface tension (1 wt%, mN/m, @ 25°C)	Foam Height (mm, 0.1 wt%, @ 25 oC, Ross-Miles, initial/5 min)
TRITON™ HW-1000	Dispersive	10.8	Insoluble	Insoluble
TRITON™ RW-150	> 100	> 16	860/30 pH=12 —/54 pH=2	135/15 pH=12
TRITON™ X-100	66	13.4	189/33	128/107
TRITON™ CG-110	> 100	—	1748/27	105/100
TERGITOL™ XD	74	—	—/38	60/25
TERGITOL™ 15-S-9	60	13.3	52/30	124/43
TERGITOL™ TMN-6	36	13.1	800/27	130/22
DOWFAX™ DF-103	22	—	—/—	1/0
ECOSURF™ EH-9	61	12.5	1066/31	60/0
ECOSURF™ LFE-635	35	9.5-10.5	315/32	0/0

Defoaming surfactant	Cloud point (°C, 1 wt%)	HLB	CMC (ppm)/ Surface tension (1 wt%, mN/m, @ 25°C)	High speed waring blender foam height (mm)		
				25°C	50°C	70°C
TRITON™ CF-10	28	12.6	75/36	58	28	10
TRITON™ CF-32	25	11.0	—/37	59	1	0

Offering overview by PCB applications

	Product	Epoxy CCL	Desmear	Photosensitive film	Film stripping	Solder resist	Solder ink	PCB cleaning
P-Series Glycol Ethers	DOWANOL™ PM Glycol Ether	+++						
	DOWANOL™ PnP Glycol Ether	+						
	DOWANOL™ PnB Glycol Ether	+						
	DOWANOL™ PMA Glycol Ether Acetate	+		+		+		
	DOWANOL™ DPM Glycol Ether			+		+		+
	DOWANOL™ EPh Glycol Ether		+					+
	DOWANOL™ PPh Glycol Ether							+
	DOWANOL™ DPnB Glycol Ether						+	+++
	DOWANOL™ TPnB Glycol Ether		+				+	+
E-Series Glycol Ethers	Butyl CELLOSOLVE™				+			
	Butyl CARBITOL™		+		+++		+	+++
	Hexyl CARBITOL™						+	+++
Amines	MEA		+++		+++			+
	DEA				+			+
	MIPA		+					+
	DETA		+++					

+: recommended
+++: commonly used

Offering overview by PCB applications (cont.)

	Product	All types of CCL	Drilling & desmear	Copper plating	Film stripping	Developer	PCB cleaning
Surfactants	TRITON™ HW-1000		+				+
	TRITON™ RW-150		+				+
	TRITON™ X-100	+			+	+	+
	TRITON™ CF-10						+
	TRITON™ CF-21				+	+	+
	TRITON™ CF-32				+	+	+
	TRITON™ CG-110						+
	TRITON™ GR-5M			+			
	TRITON™ QS-44			+			
	TERGITOL™ XD		+	+			+
	TERGITOL™ 15-S-9	+	+	+			+
	TERGITOL™ TMN-3	+					
	TERGITOL™ TMN-6	+	+	+			+
	DOWFAX™DF-103		+				+
	DOWFAX™ 100N15		+	+			
	DOWFAX™ 2A1			+			
	ECOSURF™ EH-9						+
	ECOSURF™ LF-30			+			
	ECOSURF™ LF-45			+			
	ECOSURF™ LFE-635			+			+

+: recommended

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