

SurPass 3000

CATIONIC PRIMING AGENT

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SurPass 3000 Cationic Priming Agent is a complete cleaning and adhesion promoting priming agent designed and formulated for use with photoresist on silicon, glass, nickel, gallium arsenate (GaAs), indium tin oxide (ITO) and various other metallic and non-metallic substrates. Unlike traditional microlithography priming agents, **SurPass 3000** eliminates the need for separate wet chemical processing for cleaning and priming of substrates. This is accomplished through the utilization of a unique molecular bonding process that selectively captures and removes electrostatic surface contaminants, while providing a uniform cationic monolayer for reception of photoresist. **SurPass 3000** is the only priming agent available which is completely non-hazardous and aqueous based, while providing increased adhesion over vapor primed HMDS¹. Finally, as a water based primer, **SurPass 3000** provides processing flexibility not otherwise available from solvent base and metal oxide or metal acetate priming agents.

The SurPass 3000 Advantage

<i>Process</i>	<i>The SurPass 3000 Advantage</i>
Substrate Cleaning and Adhesion Promoted Within a Single Step ~	Faster processing time. Cost savings through elimination of multi-step processing and its waste treatment. Eliminates need for substrate dehydration bake and water induced adhesion failure.
Increased Macro - and Micro - adhesion of photoresist ~	Reduced adhesion failure for increased yields. Reduced delamination and undercutting. Reduces or eliminates macro-adhesion failure in metallization.
Flexibility in Application ~	Adaptable to various processing modes allows for conversion without retooling.
Non-Hazardous Formulation ~	Eliminates personnel hazardous and waste treatment cost. Significantly reduces shipping cost.
Non-Volatile ~	Two year shelf life, does not degrade upon exposure to air. No harmful vapors or offensive odors.
Ideal for Application Where Substrates Are Recycled ~	Does not cross link with the substrate.

¹ Evaluation of both micro - and macro - adhesion compared HMDS vapor primed substrates to SurPass 3000 immersion primed substrates. Results and test methodology available in DisChem technical bulletin SP3-111397A.

◆ Increased Process Efficiency / Adaptability

SurPass 3000 is a true water based primer. As such, it is highly adaptable to the unique process flow characteristics of individual microlithography manufacturers. Its effective cleaning properties may be utilized to combine the final stages of substrate cleaning / recycling to eliminate separate wet chemical processing altogether. This can prove significant in reducing processing cycle times, as well as provide an elimination of costly chemicals and related hazards. SurPass 3000 may be used in spin coating, brush cleaning, ultra sonic and immersion applications with little or no changes to current tooling set up.

◆ Increased Yields

By utilizing a bond method that is unaffected by the presence of water molecules (vapor, humidity, condensation, etc.) or microscopic substrate irregularities, SurPass 3000 insures complete adhesion of the photoresist to the substrate. In comparison studies between SurPass 3000 and HMDS, SurPass 3000 showed nearly a two fold increase in macro-adhesion, and up to ten times an increase in micro-adhesion. Furthermore, micro contaminants remaining on the substrate or introduced after normal cleaning are removed as a potential source of failure.

◆ Lower Costs

While the price of SurPass 3000 is competitive with existing products, such as HMDS and silanes, the cost per quality savings far exceeds those of other primers. These savings can be found in increased productivity and yields, lower chemical use, storage and disposal, and where substrates are recycled, may allow for the reduction or elimination of polishing requirements. With a two-year shelf life, SurPass 3000 reduces inventory requirements and, unlike volatile organic primers, will not breakdown or loose potency once the bottle has been opened.

◆ Reduced Chemical Hazards

With the push toward ISO 14000 and the ever-increasing liability associated with storage, disposal and safety of hazardous materials, it is impossible to ignore the risks. Conventional organic solvent based priming agents, such as HMDS and silanes, pose significant health and safety concerns. HMDS, for example, is a suspected carcinogen, a strong irritant and is highly flammable (flash point 27°C). SurPass 3000 is non-hazardous and non-volatile so that associated work place safety issues are eliminated. In addition, SurPass 3000 will not impact clean air restrictions or contribute to costly waste treatment requirements.

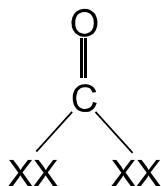
The Chemistry of SurPass 3000: Innovation

SurPass 3000 is unlike any other priming / adhesion agent used in optical media mastering. Its development is the result of DisChem's product development philosophy: to examine the requirements of the process and then develop innovative new products to satisfy the needs. This successful approach to product development goes beyond adapting current technologies to fill a need, but rather examines the need, understands the potential failure modes, and develops new products that serve as an integral part of the process.

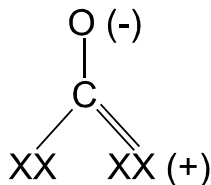
SurPass 3000 utilizes a unique bonding process which allows for the removal of electrostatic contaminants on the substrate surface, while providing a cationic mono-layer for adhesion of photoresist.

The active bonding mechanism in SurPass 3000 is an amino - heteroatom resonance structure in which shift of the double bond provides ionic bonding at the substrate and hydrogen bonding at the resist interface.

Heteroatoms are the category of elements that include Boron, Nitrogen, and Oxygen and their periodic table subsidiaries. All heteroatoms contain a pair of free electrons that allow them to partake in the formation of a double. This is represented below, where "XX" represents the specific hydroxylamine of SurPass 3000:

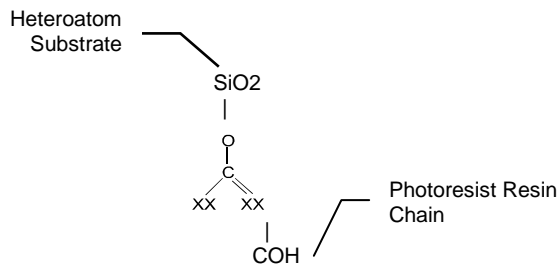


Since the electrons that make up the bond can migrate from one heteroatom to the other, the actual structure of the compound may be considered a composite of two contributing resonance structures. As such, this allows the above structure to also exist as follows, where (-) represents a negative charge and (+) represents a positive charge:



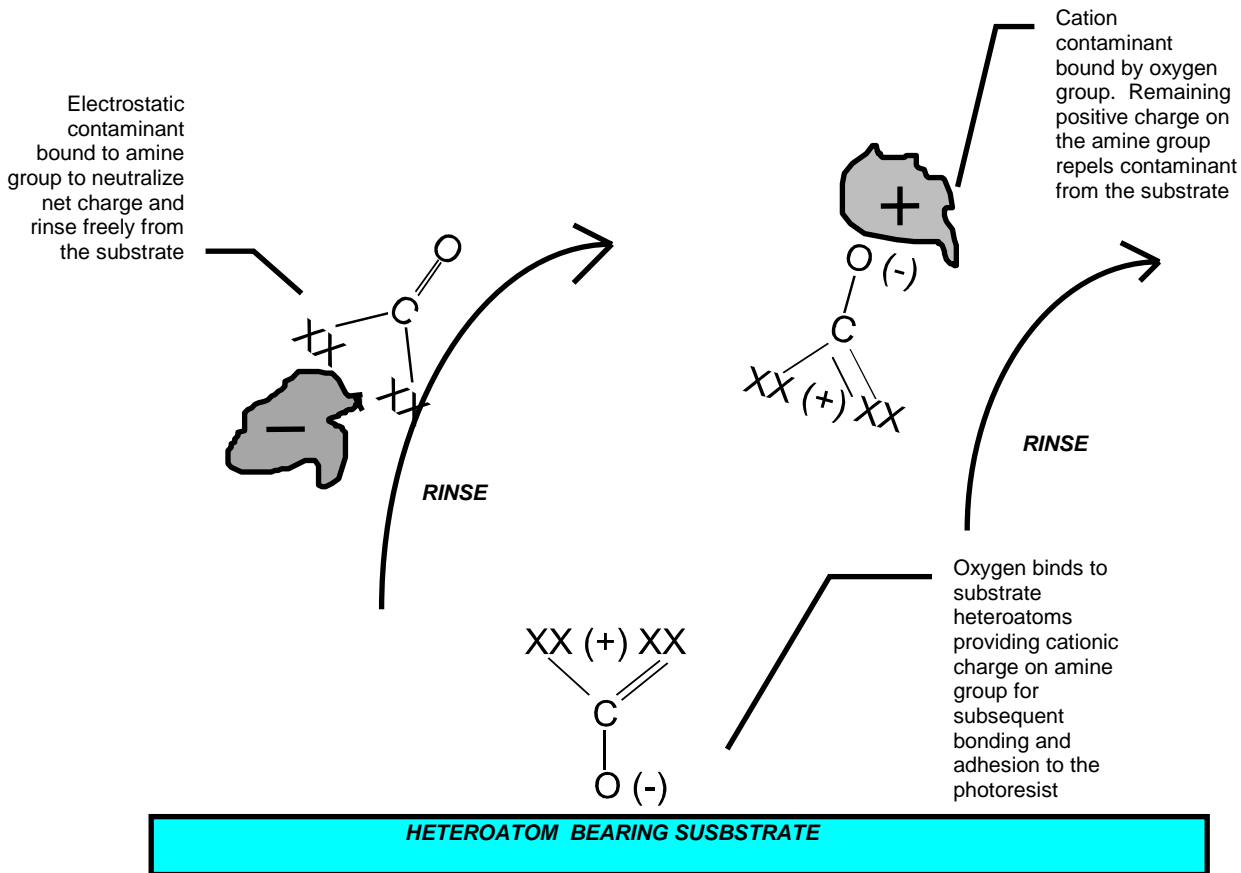
SurPass 3000 utilizes this heteroatom resonance structure between the oxygen and amine group to create a polar association between the substrate and the photoresist. Upon exposure to the substrate, resonance may allow the oxygen atom to form an ionic association with another heteroatom in the substrate (for example, the silicon or oxygen in glass and silicon wafers, gallium or arsenate in gallium arsenate, etc.) When this occurs, the SurPass 3000 molecule is bound to the substrate.

Where SiO₂ is the substrate, for example, this may be expressed in a simplified form as:



As a cleaning agent, the amine group forming association with electrostatic contaminants on the substrate believes the molecule to function. Where this occurs, the double bond remains on the oxygen, preventing it from bonding to the substrate. SurPass 3000 contains non-ionic surfactants which reduce the surface tension on the substrate so that the bound contaminants can then be removed from the substrate through rinsing. Where the contaminant is a cation, the oxygen bonds to shift resonance to the amine group. With nothing to bond to, the amine group is removed along with the oxygen - cation contaminant through rinsing.

The complete process of substrate cleaning and adhesion priming is demonstrate graphically below:



The SurPass 3000 Bond: Unsurpassed Adhesion

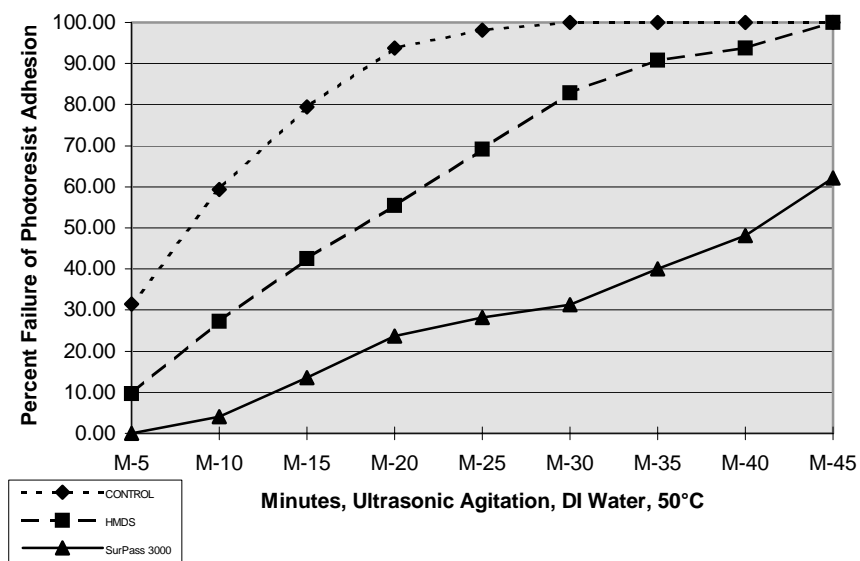
The result of the SurPass 3000 prime is an ionic resonance stabilized association between the SurPass 3000 molecule and the substrate, and a hydrogen bridge bond between SurPass 3000 and the photoresist. This provides an association that is extremely strong for reducing adhesion failure, both macro- and micro-, yet one that does not cross link with the substrate so that substrate recycling requirements are significantly reduced. In comparison studies between SurPass 3000 and HMDS, SurPass 3000 showed nearly a two-fold increase in macro-adhesion, and up to ten times an increase in micro-adhesion².

Macro-Adhesion Evaluation:

Macro-adhesion describes the ability of the priming agent to reduce failure by environmental factors such as handling, temperature fluctuations, thermodynamics, metallization stress, and compressive stress of the photoresist. Macro-adhesion was evaluated through visual examination of glass slides that were primed, coated with photoresist and exposed to ultrasonic agitation in an aqueous media. Primed and photoresist coated test slides were evaluated after each 5 minute interval of exposure to ultrasonic agitation. Presence of photoresist was evaluated by placing the slide against a template divided into 5 X 13 - 4-millimeter cells and inspected under ultraviolet light. Cells showing significant loss of adhesion, or absence of greater than 20% of the photoresist, were counted as a failure of that cell. The template configuration disregarded any failure within 4 mm of the edge of the slide as edge failure may be the result of delamination and undercutting which was evaluated separately.

Results:

Results were graphed as percent failure by time interval for each test group. SurPass 3000 shows a significant reduction in adhesion failure over both the control group and HMDS.



² Results and test methodology available in DisChem technical bulletin SP3-111397A.

Micro-Adhesion Evaluation:

Micro-adhesion describes the ability of the priming agent to reduce delamination and undercutting of the photoresist at the matrix interface, as may occur during exposure to developing or etching solutions during processing.

Study Test Groups:

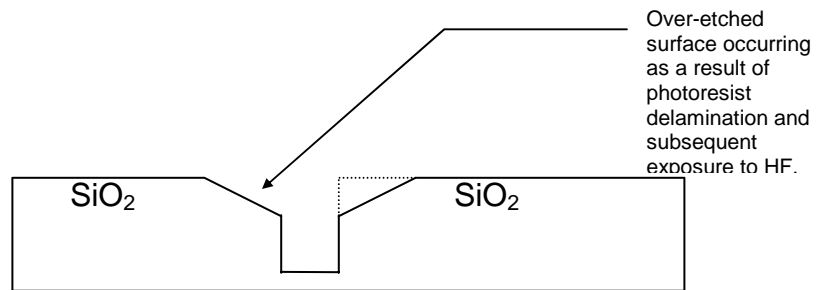
1. Silicon oxide substrate vapor primed with HMDS
2. Silicon oxide substrate spin coated with DisChem SurPass 3000. Substrate rinsed with DI water at 2000 rpm for 30 seconds, adhesion promoter dispensed on spinning substrate for 30 seconds at 2000 rpm, then rinsed again with DI water. Primed substrate was dried using light nitrogen flow.

Processing Parameters:

1. Primed substrates were coated with photoresist to obtain coatings of 4500 angstroms.
2. Coated substrates were baked at 170°C for 40 minutes in a convection oven.
3. Test groups were exposed to 100KeV electron beam, dose: 600 $\mu\text{C}/\text{cm}^2$.
4. Exposed resist was developed in solution of MIBK/IPA 1:2, 50 second immersion.
5. Coated, exposed and developed test groups etched in solutions of hydrofluoric acid (HF).
6. Etch substrates were cross-sectioned and observed under SEM for extent of delamination.

Results:

SurPass 3000 showed the same degree of delamination from an etching solution of 10% HF, 20 seconds, as occurred on a substrate primed with HMDS and exposed to a 1% solution of HF for 15 seconds.



SurPass 3000 Application & Process Cycles:

SurPass 3000 allows for flexibility not provided by either volatile organic primers (HMDS and silanes) or metallic salt primers (TiO₂, SnCl₂, etc.). As such, SurPass 3000 may be incorporated into an existing process flow plan, or implemented outside such plan to maximize process efficiency.

SPECIFICATIONS:

SurPass 3000 is available in ready to use:

SurPass 3000: 100% by volume
Filtration: Prefilter to 0.6 microns, final filter to 0.2 microns³.
Temperature: 20 - 45°C

Equipment Requirements:

Tanks: Polypropylene or high-density polyethylene. SurPass 3000 may be mildly corrosive to steel and its alloys. For this reason only very high grade of stainless steel or PTFE coated stainless steel should be used.

Filters: Use hydrophilic ultra high-density polyethylene or equivalent. Most filters designed for use with D.I. water will meet the requirements of SurPass 3000.

PROCESS CYCLES:

SurPass 3000's ease of use and integration allows for several means of application. This universal adaptability makes SurPass 3000 available to all users. Several processing options are available to maximize the process efficiency. *Note that adhesion to substrates with heavy oxide or metal coatings may be enhanced by adding 0.5% by volume sulfuric acid directly to SurPass 3000. Hydrochloric acid may be directly substituted for copper substrates.*

Dispense/Spin Coat Application:

1. Clean substrate, normal cycle.
2. To DI water wetted substrate, dispense 1 mL / second for 30 - 100 seconds, 100 - 500 RPM. Do not allow substrate to dry prior to final rinse.
3. Final rinse with DI water, 30 - 60 seconds.
4. Spin dry.
5. Process with photoresist.

Brush Cleaning:

1. DI water rinse substrate for 30 - 100 seconds with lowered brushes.
2. Dispense SurPass at 1 mL / second for 120 - 180 seconds.
3. Rinse with brushes lowered for 30 - 60 seconds.
4. Final rinse, if necessary, with raised brushes.
5. Normal drying cycle.
6. Process with photoresist

³ SurPass contains polymer chains of varying molecular weights. Though molecular weight has no effect on functionality, pre-filtration is recommended to prevent rapid filter loading with the high-end molecular weight chains.

Immersion Tank:

1. Clean substrates, normal cycle.
2. Soak substrates for 30 seconds in tank
3. Rinse 30 - 60 seconds with DI water.
4. Normal drying cycle.
5. Process with photoresist.

Ultra Sonic Cleaning:

1. Immerse substrate in ultra sonic tank for 1 - 2 minutes.
2. Rinse with DI water for 30 - 60 seconds.
3. Normal drying cycle.
4. Process with photoresist

Application cycles may vary. Your DisChem representative can evaluate your current process to provide the optimum application cycle to fit your needs.

SurPass 3000 and Coating Thickness:

SurPass 3000 has been shown to increase the photoresist coating thickness, when applying by spin coating. This is believed to be the result of higher surface tension occurring on SurPass 3000 primed substrate which, in turn, affects the dispersion rate of the photoresist during coating. As such, compensation may be required in resist coating speeds or time, or in the viscosity of the photoresist.

Substrate Recycling:

In the formation of the inter-matrix bond between the photoresist and the substrate, SurPass 3000 creates an ionic resonance bond with the heteroatoms in the substrate. This bond, though typically much stronger than a covalent bond, does not cross-link and is completely reversible. This may significantly reduce polishing requirements where substrates are recycled. The SurPass 3000 layer is easily removed from the substrate surface in normal acid and alkaline recycling processes. All metal should be removed from the substrate by acid stripping, typically in 30 - 50% nitric acid. Following the acid strip and water rinsing, the substrates should be immersed in a high detergency alkaline bath. DisChem's **mediaPrep LS** is highly recommended for its detergency, and emulsifying properties and design compatibility characteristics.

Waste Treatment:

This product also contains biodegradable surfactants (non-ionic). Always dispose of treated wastes in accordance with local, state and federal regulations. See the product MSDS for further information on regulated constituents.

SurPass 3000 Product Availability and Ordering Information:

SurPass 3000, is provided ready to use and pre-filtered to 0.45 microns. SurPass 3000 is also available in concentrated form, SurPass 3000HC, pre-filtered to 1.6 microns.

Product Inquiries & Ordering Information:

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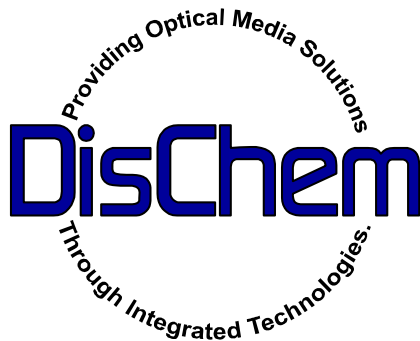
Product Codes / Description:

SP301- SurPass 3000, 1 gallon bottle
SP302 - SurPass 3000, 2 X 1 gallon bottles
SP304 - SurPass 3000, case of 4 X 1 gallon bottles
SP305 - SurPass 3000, 5 gallon tote
SP3D1 - SurPass 3000DSR 8X Concentrate, 1 gallon bottle

Note: 1 gallon = 3.785 Liters

Please call your DisChem representative or authorized agent for pricing and availability. This product may require license for export outside the United States.

This product is protected by US and international patents



DisChem Mission Statement

DisChem is dedicated to serving the needs of the optical media industry through providing innovative solutions for success. We provide the highest quality products and services available, unmatched cost per quality.

Providing Optical Media Solutions for Your Success!