DJ MICROLAMINATES, Inc
Dry Film Sheets

SUEX Epoxy Thick Film Sheets (TDFS)

Preliminary Data Sheet

SUEX TDFS are thick photoimagable epoxy sheets for wafer level packaging and MEMS applications. The sheets consist of a cationically cured modified epoxy photoresist between two throw-away layers of protective polyester film (PET). The epoxy photoresist formulation contains an antimony free photoacid generator and is prepared under a highly controlled solvent-less process, which provides uniform coatings. The solvent developed negative working photoresist is sensitive to UV radiation in the range of 350 – 400nm.

SUEX is compatible with and exhibits good adhesion to: silicon, silicon nitride, copper, gold, glass, polymers and other metals and oxides.

AVAILABILITY

Sheets are available in thicknesses from 100µm to 1mm and are pre-cut into standard wafer and panel sizes for lamination to the substrate. They are extremely easy to use and ready for lithographic processing in minutes.

Standard Thicknesses:
100, 150, 200, 250, 350, 500, 650, 750 µm and 1mm.

Precut Sheets:
Round, round with flat, square, rectangular or custom. 96mm, 146mm, 196mm wafer cut, and 100mm X 100mm sq up to 300mm X 450mm panels.

PROCESSING

SUBSTRATE PREPARATION: Substrates should be free of organic contamination and metal oxides. Cleaning is recommended immediately prior to lamination. Typically adhesion promoters, such as HMDS, are not required.

LAMINATION: Remove the top PET cover sheet prior to lamination. Lamination equipment includes hot roll laminators, roll-on plate laminators and vacuum laminators.

Recommended conditions for hot roll lamination:

Temperature:	60 - 75°C for all rolls and plates
Pressure:	5 – 10 psi (30 – 65 kPa)
Speed:	0.5 – 1.5ft/min (0.15 – 0.5m/min), thicker films may require slower speeds

Recommended conditions for vacuum lamination:

Temperature:	60 - 80°C
Vacuum:	10 – 50 Torr
Pressure:	1-2.5kg/cm^2

Detailed recommendations are provided in our “Preliminary Lamination Guidelines”.

BAKE: A post lamination bake is normally not needed or recommended. For improved adhesion and surface quality, the laminated article may be baked on a hotplate at 85 - 95°C for 1 – 5 minutes.

PET REMOVAL: After the substrate cools to room temperature, the remaining PET film can be left on the laminate to protect the resist surface until use. It can then be removed either prior to exposure for better resolution or prior to development to eliminate mask sticking.

EXPOSURE: For optimum resolution i-line filters are highly recommended for improved resolution and sidewall acuity. The dose will vary depending on resist thickness, substrate, process and other requirements. For estimated doses on silicon wafers see Table 1.

POST EXPOSURE BAKE (PEB): The PET coversheet must be removed prior to PEB. We recommend a 60 - 65°C oven bake for 1 – 5 minutes followed by a 95°C bake for 5 – 10 minutes. The PEB can also be done on a level hotplate.

DEVELOPMENT: Develop SUEX in PGMEA (propylene glycol methyl ether acetate) at room temperature with mild agitation. Develop times for best resolution and development are shown in Table 1.

RINSE/DRY: Wash the developed wafer in isopropyl alcohol, then immerse in clean IPA for 60 seconds.

HARD BAKE (Optional): If required, bake at 125°C/60 min, 150°C/30 min or 150°C/15 min. A 200°C hardbake for 30 – 60 minutes is required to remove all volatile components from the cross-linked film.

REMOVAL: SUEX is typically used as a permanent highly cross-linked film and is not intended to be removed. For films that have not been hard baked, an NMP based remover can be used to lift the film from the substrate. Hard baked films can be removed using oxygen plasma ashing equipment.

PLATING: SUEX is compatible with acid copper, tin/lead, tin, nickel sulfamate, most lead-free electrolytes, and acid gold plating baths. Plasma etching is recommended to remove organic contamination and prepare the surfaces for electroplating.

STORAGE: SUEX sheets should be stored in a standard temperature controlled environment. When stored under these conditions, the shelf life is 1 year from date of manufacture. Prior to use, SUEX should be stored between 21°C (70°F) to 25°C (77°F) for 15 – 18 hours for best results and ease of processing.

DISPOSAL: SUEX is a non-regulated material . Dispose in accordance with all local, state and federal environmental regulations.

ENVIRONMENTAL, HEALTH AND SAFETY:
Refer to our EX SUEX Series TDFS Material Safety Data Sheet.

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Table 1

Process conditions for SUEX TDFS on silicon wafers

Thickness, µm	100	150	200	250	350	500	650	750
% Transmission	77	70	59	51	39	26	18	13
Filtered Dose, mJ/cm^2 @ 365 nm	900	1100	1300	1500	2000	2500	4000	5000
No Filter Dose, mJ/cm^2 @ 365 nm	450	500	575	675	900	1150	1800	2250
PEB, min/ºC	5/65+10/95	5/65+10/95	5/65+10/95	5/65+10/95	5/65+10/95	5/65+10/95	5/65+10/95	5/65+10/95
Face Down Devl Time, min	30	30	60	60	75	110	125	150

Properties of CURED SUEX FILM

Property	Values	Measuring Method
Tg, DMA max tan δ	173ºC	DMA
5% wt loss temp/Decomp onset	356 ºC/398 ºC	TGA
1%/hr decomp temp in N_2	262 ºC	TGA
CTE RT, α_1/α_2 ppm	50, 63, 190	TMA
Shrinkage X/Y, Z	<1%	CD, FT loss
Residual stress, MPa	6 est*	Wafer Bow
Modulus, GPa	3.9	ASTM D3379-75, Dage tensile pull
Tensile Strength, Mpa	86	ASTM D3379-75, Dage tensile pull
Elongation	8%	ASTM D3379-75, Dage tensile pull
Bend Radius, cured 100µm film	<1 mm	spindle
Adhesion, MPa Si Cu Al/Cu Glass (borosilicate) Quartz	 70 80 54 61 60	Dage 4000 shear
Dielectric Constant	3.7	ASTM D150-98
Dielectric Loss, Tan δ	0.038	ASTM D150-98
Dielectric Strength, KV/mm	100	ASTM D149-97A/JIS C2110
Volume Resistivity, Ωcm	$8.1\text{X}10^{15}$	ASTM D257-07
Surface Resistivity, Ωcm	$2.2\text{X}10^{16}$	ASTM D257-07
Moisture Uptake, 24hr RT soak	1.5%	ASTM D570-98

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