SUEX® Thick Dry Film Sheets (TDFS)

Product Data Sheet – Rev June 2020

SUEX® TDFS are photo imageable epoxy sheets for plating, wafer level packaging and MEMS applications. The sheets consist of a catatonically 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 – 395nm.

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

PRODUCT AVAILABILITY

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

Standard Thicknesses:
100, 125, 150, 200, 225, 250, 300, 350, 400 and 500µm.

Custom thicknesses up to 1mm are available upon special request

Precut Sheets:
Round/wafer cut or square: 46/48, 72/73, 96/98, 146/148, 196/198 and 296/---.
Square, rectangular or custom from 98mm to 298mm sq.
Up to 500X600mm flat sheets.

PROCESSING

SUBSTRATE PREPARATION: Substrates should be free of organic contamination and metal oxides prior to lamination. Cleaning and drying is recommended immediately prior to lamination. Dehydration bake but may require further cleaning and surface activation prior to lamination. For copper, glass, gold, etc. see special treatment recommendations. Adhesion promoters are typically not useful.

LAMINATION: Remove the clear PET cover sheet immediately prior to lamination. Laminate on a hot roll laminator. Do not allow sheets to contact substrate until immediately (<1cm) before rollers. Vacuum laminate over topography for thick films.

Recommended conditions for hot roll lamination:

Temperature:	60 - 70°C for all rolls
Pressure:	5 – 10 psi (30 – 65 kPa)
Speed:	0.5 – 1.5ft/min (0.15 – 0.5m/min), thicker films may require slightly slower speeds

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 80 - 85°C for 5 minutes.

PET REMOVAL: After the PLB bake the remaining PET film should be left on the laminate as the substrate cools to room temperature to protect the resist surface until use. Remove just prior to exposure.

EXPOSURE: For optimum resolution i-line filters or soda lime masks are highly recommended to remove wavelengths below 350nm for improved resolution and sidewall acuity. The dose will vary depending on resist thickness, substrate, process and other requirements. See Table 1 for estimated doses on silicon. Mask sticking: Use anti-stick coating on the mask.

POST EXPOSURE BAKE (PEB): The PET coversheet must be removed prior to PEB. We recommend a 85°C oven bake for 30-60 minutes for lower stress or a 95°C bake for 5–10 minutes for speed. Cool slowly over 3-5 hours for minimum cracks and best adhesion.

DEVELOPMENT: Develop at room temperature using a two bath PGMEA (propylene glycol methyl ether acetate) system, face down with mild agitation. Develop times for best resolution are shown in Table 1.

RINSE/DRY: Wash the developed wafer in isopropyl alcohol, then immerse in clean IPA for 1 to 5 minutes.

HARD BAKE (Optional): If required, bake at 125°C/60 min, 150°C/30 min or 150°C/15-20 min. A 200°C hard bake for 30 – 60 minutes is required to remove all volatile components from the film.

REMOVAL: SUEX is generally 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 may lift the film from the substrate. Hard baked films are generally removed using CO_2 laser ablation equipment.

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

STORAGE: SUEX sheets should be stored in the original black packaging in a standard, temperature-controlled environment between 18°C (65°F) to 25°C (77°F). When stored under these conditions, the shelf life is up to 2 years from date of manufacture.

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

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Table 1: Process conditions for Thick SUEX TDFS on Silicon Wafers

Thickness (µm)	**100**	**150**	**200**	**250**	**350**	**500**
% Transmission	77	68	59	51	39	26
UV Filtered Dose, mJ/cm^2 @ 365 nm	1000	1200	1350	1500	1900	2500
No Filter Dose, mJ/cm^2 @ 365 nm	450	515	575	675	900	1150
PEB, min/ºC	30/85	30/85	35/85	40/85	45/85	45/85
Devl Time Face Down, min	35(20 + 15)	50(30 + 20)	60(40 + 20)	75(50 + 25)	100(70 + 30)	140(100 + 40)

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
Min 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	8.1×10^{15}	ASTM D257-07
Surface Resistivity, Ωcm	2.2×10^{16}	ASTM D257-07
Moisture Uptake, 24hr RT soak	1.5%	ASTM D570-98

For ENVIRONMENTAL, HEALTH AND SAFETY Information:
Please refer to the SUEX® Series TDFS Safety Data Sheet

Notice: All statements, recommendations and information contained herein are based on test results that DJ MicroLaminates, Inc. believes to be accurate and reliable. The user shall determine the suitability of this material for his or her intended purpose and application. No warranties, whether expressed or implied for fitness for a particular purpose, shall apply to this material.

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