# DMI-3006

## Modified Polyimide based Negative type Photoresist

Warpage on silicon is generated through thermo-mechanical interactions of various organic materials with silicon during assembly process. The magnitude of warpage is effected by: 1) difference of the CTE between Si and resin. 2) modulus of resin. 3) processing & curing temperatures. Warpage increases as wafer diameter gets larger & wafer thickness gets thinner.

**DMI-3006** is `The super low-stress resin' for buffer layer and other organic layers. It shows much lower tensile modulus and much lower cure temperature than conventional resins (Table.1). **DMI-3006** provides the benefits of a polyimide resin film without warpage (Fig.1). Other benefits of the material include very low moisture absorption, excellent electrical performance and enhanced adhesion to metals, especially copper. **DMI-3006** can be used with a general photoresist process (Fig.2).

**Table.1 Differentials compared with conventional resins**

| | Polymer type | Patterning process | Tensile Modulus (GPa) | Cure Temp. (°C) |
|---|---|---|---|---|
| Conventional A | PI Type | - ve | 3.5 | 375 |
| Conventional B | PBO type | + ve | 2.8 | 320 |
| Conventional C | PI Type | + ve | 3.0 | 350 |
| DMI-3006 | Unique Polymer | - ve | 0.1 | UV Cured |

## DMI-3006 Features

1. No Warpage due to Very Low Tensile Modulus
2. Very High Electrical Reliability
   (Design of Low Moisture Absorption)
3. UV Cured – Low Thermal Requirements
4. Low Cure Shrinkage
5. Good Storage Stability
6. High Heat Resistance
7. Good Electrical Properties
   (Dielectric Constant, Dielectric Dissipation Factor)

a) Conventional resins

b) DMI-3006

**Fig.1 Warpage comparison of 50um thick wafers with 10um films**

## Processing Guidelines

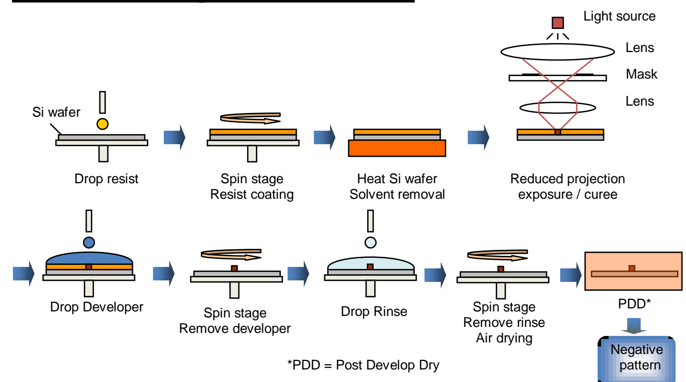


**Fig.2 DMI-3006 Patterning Process**

### Coating

**DMI-3006** is applied by the spin coating. **DMI-3006** standard grade is adjusted to the viscosity of 200 – 250 mPa. Figures.3 shows the information of spin conditions to achieve the desired film thickness. Viscosity can be adjusted with solvent dilution. **DMI-3006** can be applied in 5 to 20 um film thicknesses.

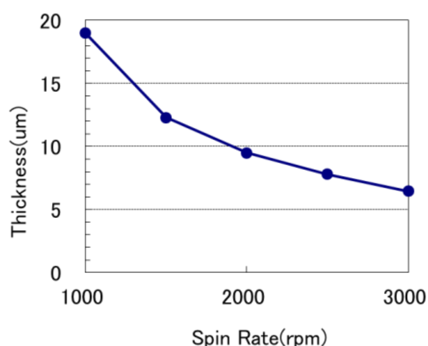


**Fig.3 Spin speed vs Film Thickness**

## Pre-baking

A level hotplate with good thermal control and uniformity is recommended for use during the Pre-bake (solvent removal) step of the process. The recommended settings: 100 °C, 3 - 10 minutes.

## Exposure

**DMI-3006** is exposed with i-line (365nm). Fig.4 shows the photosensitive curve using high-pressure mercury vapor lamp. The exposure energy required for patterning is > 500 mJ/cm$^2$.

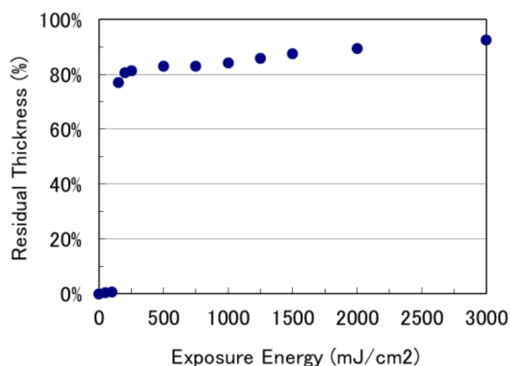


**Fig.4 Photosensitive Curve**

## Development & Rinse

**DMI-3006** is designed for spray-puddle, and any other developing equipment. The recommended developer is **R1247** which consists of organic solvents. The simple & recommended process is developing on a wafer with a spin coating as shown below.

a) Drop **R1247** on the wafer after exposure processing

b) Developing (23 °C, 70 rpm, 40 sec. + 2000rpm, 10 sec.)

c) Rinse (23 °C, 70 rpm, 10 sec. + 2000 rpm, 15 sec.)

d) Drying

## Post Develop Dry (PDD

A PDD temperature of 175 °C and for a time of 60 minutes is typically used.

## Physical Properties

| | Condition | Unit | Value |
|---|---|---|---|
| Tensile Strength | Instron | PSI | 1,180 |
| Elongation at break | Instron | % | 62 |
| Tg | TMA | ºC | 54 |
| Thermal Expansion, α1/α2 | TMA | ppm/ºC | 164/222 |
| Dissipation Factor | IPC-TM-650 2.5.5.9 | 1.5 GHz | <0.001 |
| Dielectric Constant | | 1.5 GHz | 2.6 |
| Modulus at 25ºC | DMA | GPa | 0.1 |
| Decomposition Temp. (in air) | TGA | ºC | 446 |
| 5% Weight Loss Temp. (in air) | TGA | ºC | 358 |
| Water Absorption | 23ºC immersion, 24 hours | % | 0.1 |
| Moisture Absorption | 23ºC, 50% RH, 24 hours | % | 0.1 |

## Packaging and Storage

Packaging container is a glass or plastic gallon bottles (net 3.8 kg) or glass or plastic quart bottles (net 0.9 kg). Keep in sealed original container away from oxidants, sparks and open flames. Refrigerate until use and bring to ambient temperature prior to use. Protect from light and heat. Empty container may contain harmful residue and vapors.

## Handling Precautions

Refer to the current Safety Data Sheet (SDS) for detailed information prior to handling.

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