



Spin Processing of Negative Tone Solvent Developable Polyimide

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Polyimide is frequently used as a protective barrier coating for active semiconductor or MEMS devices.

While photoimageable, the material has sufficient rheological and chemical differences from photoresist that requires the processing tool have features to accommodate those differences. The features include but are not limited to the following:

At the coater:

- Programmable dispense height is very helpful to ensure best coating uniformity. Generally these materials are cast rather thick and +/-5% coating uniformity is considered good.
- Control of acceleration is important for the best uniformity
- The material can be deposited to “just” get to the edge by control of spin speed, acceleration, and time.
- The edge bead is substantial and unavoidable.. EBR is not recommended prior to bake since the solvents used (NMP) have a relatively low vapor pressure and remain “oily.” EBR will only have the effect of thinning the film, rendering it less uniform.
- Spin time has a greater effect on film thickness than spin speed.

At the soft bake:

- The film outgases a substantial amount of vaporous material that must be disposed. The material will condense on the cooler surfaces of the interior of the bake module. A properly designed bake module will dispose of the re-fluxable material in such a way that will obviate the possibility of reflux ON the wafer. If properly designed and built, the bake module will never require cleaning and never create a defective wafer.
- As the cast films tend to be thick, it is important to raise the bake temperature slowly by either using a series of hot plates, or alternatively and perhaps more appropriately, to simply ramp the temp of the wafer up very slowly permitting solvents to dissipate without creating film defects. Servo controlled lift pins perform this task admirably; it cannot be done with pneumatic control of lift pins.

At the develop, it is important to note that if the tool is properly designed for this purpose, the coat module and the develop module can in fact be one. A dual arm tool can use

one arm as the develop arm and one as the coat dispense arm. A further advantage to using a dual arm is to maintain the spin cup in a clean condition as the solvents for both processes are entirely compatible. if not identical:

- The develop solvent is best dispensed in an oblique stream since the contrast ratio is very high and the material does not really dissolve in the develop, as it forms as it forms a gel-like material that needs to be “swept” away. While a spray will work, a stream works better, faster, and uses less solvent for that reason.
- Since the edge bead tends to be very thick, the develop process can be concentrated and directed at the edge of the wafer initially, ultimately reducing the edge bead without affecting the active devices areas inward from the edge.

About Mr. Gary Hillman

Mr. Gary Hillman has enjoyed a long and distinguished career in the engineering and semiconductor industries. A graduate of the Georgia Institute of Technology with a B.S. in Ceramic Engineering, Mr. Hillman began his career with Corning Glass Works in Corning, New York.

Mr. Hillman has made multiple critical contributions while working at a variety of companies during his long and successful career, including receiving a patent for the semiconductor industry’s first practical “robotic” wafer handling system while working at Machine Technology, Inc. in Parsippany, New Jersey. Since then, Mr. Hillman has 22 patents to his credit.

Mr. Hillman served as the Chairman of SEMI Standards in 1987 and Chairman of SEMI in 1989.

In 1994, Mr. Hillman and a group of others formed Service Support Specialties, Inc. and Creative Design Corporation. Service Support Specialties, also known as S-Cubed, evolved over time into a leading manufacturer of Photoresist processing tools and associated robotics.

Mr. Hillman has helped to develop significant advances in the engineering and semiconductor industries. He and his dedicated team at S-Cubed work to meet and exceed the needs of their customers.

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