

SU8spinner

STANDARD OPERATING PROCEDURE

CORAL

Name: SU8spinner

Model: Headway Research Inc., Model CB15

Location: TRL

What it does: polyimide spinner

Introduction: This machine is used for spinning Microchem's SU8 2000 series negative epoxy resists. These resists are quite robust mechanically and chemically, once cured by light and heat, enabling structural usage in many applications. However cured SU8 is essentially impossible to remove without aggressive applications of strong oxidizing acids, like double piranha cleans. Partially cured SU8 must not be allowed to migrate into the rest of the cleanroom because applications like heat or plasma etching will cause it to be deposited on chamber walls in a very destructive manner. This SOP will present ways to process SU8 without destroying downstream equipment. Sample process steps will be presented here but specific recipes should be obtained from [//www.microchem.com](http://www.microchem.com), under products/SU8-resists. Note: we are allowing only the 2000 series of resists because of the quicker drying and greater acetone solubility of uncured resists. Be certain you clean up all SU8 traces on labware or counters with acetone or PM Acetate before it hardens!

All wafers are classified in TRL's "purple-SU8" color classification during processing, then revert to TRL's "red-Au" contamination level after processing, and tweezers, beakers and chucks should correctly be tagged "purple".

Safety: Chemicals typically used here are moderately hazardous to touch or breathe, and generally will dissolve vinyl gloves, so care should be taken and green nitrile gloves should be worn. You need be aware of the hazards of the coating being applied to the sample, as well as for cleaning or developing solvents and ancillary chemicals. Never use these chemicals out of a fume hood enclosure similar in function to the SU8spinner, and never put your head into a fume hood for any reason.

Users should be familiar with the MSDS for all chemicals used; see the MSDS "solvent" book on the first floor of bldg 39, or refer to the Microchem website.

The SU8spinner is capable of spinning wafers at speeds in excess of 5000rpm, so care must be taken when starting, running and stopping the spinner. Wafers should be well centered and balanced before starting a run. Always remember to wear your safety glasses; the high spin speeds of the vacuum chucks can impart dangerously high velocities to wafers or silicon pieces.

Procedure: **Preparation:** Start by making sure you have the machine reservations in CORAL, and then "engage". Make sure the removable bowl is inserted and that all labware you intend to use is of the SU8 purple-dot classification, including developer bowls and tweezers. All wafers processed in photo are re-classified as gold, TRL's red-dot classification after leaving the photo area. Your wafers should be clean and dry before starting, often by Using a piranha type clean followed by an 10 min+ oven or hotplate dehydration. Do not use HMDS prior to coating.

Coating: If Using hot plates, level two exhaust vented hot plates, and make sure they have smooth piece of disposable aluminum foil on top of the heating element. Choose a flat metal hotplate top for uniform conduction heating: consider the difference in heat transfer between the desired uniform conduction heating and indirect conduction and convection heating of a wafer only partially in contact with the hot plate. Set them at 65 and 95C. If you are Using the SU8oven,

make sure it is at the correct temperature, and read the Microchem website for the correct bake times. Never use any box oven other than the SU8oven, and never use a hotplate or oven unless it has been foil protected.

We will present a recipe for SU8-2050 targeting ~ 100u. Using hot plate heating, but other viscosity 2000 series resists are available, and other thicknesses for 2050 are realizable.

Set the SU8spinner on the two stage “speed 1&2” setting; speed 1 at 500 rpm for 10 seconds and speed 2 for 30 seconds at your recipe specific speed; 1500 rpm in our case. Put your wafer on the appropriately sized chuck and make sure it is well centered.

Note: your wafer **MUST** be bigger than the chuck in all directions, or resist will be sucked into the spinner by the wafer vacuum.

Static dispense resist onto clean, dehydrated, wafers. Our experience shows better results for pouring from the bottle from a very low position, preventing thin filaments from dropping down over the wafer causing bubble defects. When the resist pour covers just over a quarter of the area of the wafer, twist the bottle and lift to terminate the pour without strings and without getting resist on the threads. Don't put the cap on over resist covered threads as it will dry and create thousands of particle defects, if you can ever get the cap off again. After moving the wafer to the hot plate, and clean the tweezers with acetone or PM Acetate, rinsed with 2-propanol, always allowing waste solvent to drain into the funnel into the solvent waste bottle. Replace the solvent waste cap when done; the funnel may not be left in place! Let the SU8 remain and cure in the removable coater bowl; staff will periodically replace this item. Do not let solvents go into the coater bowl, as they will prevent the SU8 from curing, and lower its viscosity enough to allow it to flow down towards the coater shaft.

Use a swab with a squirt of acetone on it to “edge bead” clean the wafer, or wet resist will be deposited upon the chucks of downstream equipment such as the hot plates and aligner.

Put the wafer on the 65C hotplate pre-bake for about 4 minutes in our SU8 2050 targeting 100u thickness example, then move it to the 95C hotplate without cooling or stopping, for the 20 minute softbake. At the end of the softbake, after cooling, the wafer may not still be wet! If so, the heating was likely non-uniform. If the wafer is still wet, the SU8 would ruin your mask and possibly damage the aligner, so it may not proceed further until at least a surface film hardening occurs.

Exposure: reserve and engage “EV1” under CORAL, do not choose the shorter wavelength “KS2”. See the EV1 SOP for specific machine instructions. Select the 4” gold (red-dot) chuck; and center the removable SU8 separation disk on the chuck. Expose, in our example, for between 320 and 530mJ/cm², which at 10mW/cm², means between 30s and a min, through your negative tone mask. If Using a transparency in flood expose mode, don't forget to put a clean blank mask on top to make it conformal to the wafer. Make sure the separation disk is cleaned and returned to its proper storage location when done.

*Consider Using a UV340 filter to eliminate the undesirable shorter wavelengths, which scatter and absorb readily in SU8, causing a “T-topping” effect of exposing, and rendering insoluble, the top layer of resist. This filter works very well with chrome masks, but when Using transparency masks, the bubbles naturally present in the Clearfield part of the film act like minute masking points, and you end up with small perforations in your SU8 noticeable after developing. To limit this effect, overexpose by several minutes to blur these defects as much as possible. In all cases with a filter, overexpose by about 40% to allow for transmission losses.

Post Exposure Bake: (PEB) Put on the 65 and 95C hot plates for 1 and 10min respectively in our example; if you get tensile cracking, consider going back to the 65C plate briefly to cool more slowly.

Develop: Develop in PM Acetate, PGMEA, or SU8 developer, in purple dot Pyrex bowl. If fully developed, rinse developer (displacing the solvent) off of the wafer with 2-propanol (IPA). If a milky white color is apparent, it is from partially dissolved SU8; your wafer may need more developing. Dry the IPA with the N2 gun and inspect. If complete, pour developer into solvent waste and rinse the Pyrex bowl well with IPA, and return it to the purple dot shelf.

Failure Modes: If resist dissolves in areas where it should remain, either the PEB was too cold (non-uniform) or the time was too short, or the exposure time was too short. If resist doesn't dissolve where it should, in areas not near exposed features, the softbake or PEB was too long or hot. If resist doesn't dissolve only in areas adjacent to exposed features, it was either over exposed or the mask was in poor contact, or you may need some type short wavelength filter. If resist separates or lifts off from wafer, cool the wafer down more slowly after PEB by turning the hot plate off and leaving the wafer in place to cool slowly for 10 minutes.

Author: Kurt Broderick, 2/04 (replaces SOP for pispinner)