

Microfluidics at QNF

Process Link: <https://www.fabublox.com/process-editor/70e6195b-900a-48e8-8b05-70dd807d973f>

Process Flow:

Substrate:

- Silicon: 500 μm thick
- Comments: Standard 4" wafer

Step 1: Plasma Descum

- Tool: **DE-07**
- Recipe: EAC_Descum
 - Gas composition: O₂
 - RF Power: 150 Watts
 - Time: 5 mins
 - Flow rate: 99 sccm
- Comments: Confirm recipe matches the parameters above. This is for dehydration + cleaning, which should help adhesion. After removing wafers from chamber it is important to move quickly to Step 2.

Step 2: Spin-on Resist

- Tool: **SPN-08**
- Resist: HARE SQ 50
- Expected Film Thickness: 50 μm
- Recipe: 0_staff_2000k_500 recipe (or whatever name is closest to that)
 - Step 1: 500rpm, 5s
 - Step 2: 2000 rpm, 45s
- Comments: Place cleanup wipes around the inside of the bowl to catch extra resist. Pour enough resist in the middle of the wafer to cover $\sim 2/3$ before spinning.

Step 3: Soft Bake

- Tool: **Hot Plate Tower**
- Step 1
 - Bake Temperature: 65 $^{\circ}\text{C}$
 - Bake Time: 5 mins
- Step 2
 - Bake Temperature: 95 $^{\circ}\text{C}$
 - Bake Time: 15 mins
- Comments: Values are as written on datasheet. This step removes excess solvent from the resist, making it less sticky. The given times should be the minimum – going over time is fine.

Step 5: Lithography Exposure

- Tool: **MA-03**
- Process type: First mask, no alignment needed
- Expected exposure dose: 180 mJ/cm^2
- Mask type: Chrome on glass
 - Long pass filter: YES
 - Expected intensity: 47% of lamp output
 - Suggested exposure time: 20.2 secs \square based on posted 8.9 mW/cm^2 value
- Mask type: Film/transparency + glass plate
 - Long pass filter: NO
 - Expected intensity: 68.5% of lamp output
 - Suggested exposure time: 13.8 secs \square based on posted 13 mW/cm^2 value
- Comments: Exposure dose value as written on datasheet. Exposure time = dose \div intensity. See the values as posted at the tool/on NEMO, update exposure time as needed. Dose can affect sidewall profiles, so features may not properly adhere to wafer if too underdosed.

Step 6: Post Exposure Bake

- Tool: **Hot Plate Tower**
- Step 1

- Bake Temperature: 65 °C
 - Bake Time: 1 mins
- Step 2
 - Bake Temperature: 95 °C
 - Bake Time: 5 mins
- Comments: Values are as written on datasheet. Split into two steps of increasing temperature to reduce stress. This step completes the crosslinking of the resist into a solid. Image should start to be more clearly seen after these bakes.

Step 8: Develop

- Tool: **WB-16**
- Step 1
 - Chemical: PGMEA (HARE SQ Developer)
 - Time: ~6 mins
- Step 2
 - Chemical: IPA (Isopropyl Alcohol)
 - Time: ~3 mins
- Comments: Pour out chemicals ~3min in advance to let them come to room temperature to avoid stress/cracking in resist structures. Development times may vary depending on structure density and aspect ratio. If IPA creates a hazy residue, there is still undeveloped resist on the wafer. It is recommended to follow up the baths with a quick rinse over the cup sink with first PGMEA and then IPA before drying.

Step 10: Flood Exposure

- Tool: **MA-03**
- Process type: No mask, no alignment needed
 - Long pass filter: NO
 - Expected intensity: 100% of lamp output
 - Suggested exposure time: 10+ secs
- Comments: Time does not need to be exact. This step ensures that the adequate exposure dose is reached throughout the structures. (Can use the dose already set on the tool if >10s)

Step 11: Mix & Add PDMS

- **Must be done in PDMS-dedicated space within Bay 6**
 - Ratio: 10:1 base to curing agent
 - Mixing Time: 5 mins
- Comments: For a new master, ~35g PDMS + 3.5g curing agent. For refilling, ~12g + 1.2g curing agent

Step 12: PDMS Degassing

- Tool: **Vacuum chamber in PDMS space**
 - Time: ~30 min or until all bubbles are cleared

Step 13: PDMS Bake

- Tool: **Oven in PDMS space**
- Name: Bake
 - Bake Temperature: 80 °C
 - Bake Time: 30 mins
- Comments: Until completely solid