



HSQ SPIN CURVES

This document provides thickness curves and spinning guidelines for various formulations of HSQ (Hydrogen Silsesquioxane) electron beam resist. Please refer to the Headway spinner SOP before reading this document.

Resist formulation: Stock HSQ (6%) and dilute HSQ in MIBK 1%, 2%, 3% (by volume)
Spread cycle: RPM = 100, RAMP = 1 sec, Time = 10 sec
Spin cycle: RPM = 1000 – 5000, RAMP = 2 sec, Time = 40 sec
Ramp is always maintained at 2 sec i.e., ramp rate increases!
Pre-bake: 5 min @ 90°C on hot plate (set-point temp. ~ 135°C)

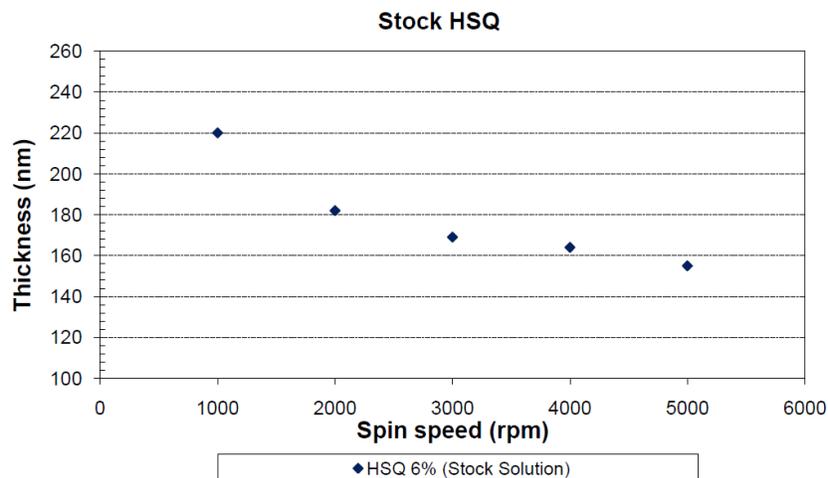


Figure 1 Spin curve for stock 6% HSQ (constant 2 sec ramp time)

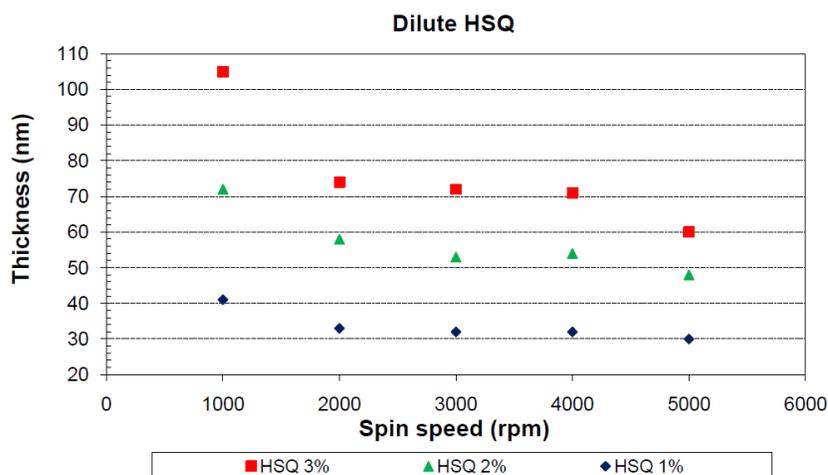


Figure 2 Spin curves for dilute HSQ in MIBK formulations: 1% HSQ in MIBK (blue diamonds), 2% (green triangles), and 3% (red squares). A constant 2 sec ramp time was used in all cases.



DATA:

The following data was used to generate the spin curves above.

RPM	RAMP (sec)	HSQ 1% (nm)	HSQ 2% (nm)	HSQ 3% (nm)	HSQ 6% (nm)
1000	2	41	72	105	220
2000	2	33	58	74	182
3000	2	32	53	72	169
4000	2	32	54	71	164
5000	2	30	48	60	155

Worst case error estimates vary from ± 3 nm (1%) to ± 10 nm (6%).

NOTES:

- The stock 6% HSQ bottle is present in the NanoFab fridge XR-1541 (-006). Please pour the resist solution into a separate labeled plastic container for your use and store in the fridge. If you would like to test-use some HSQ, there are small containers labeled 'Nanofab Stock' and marked with a green sticker on the lid. All formulations are available.
- **Whenever you'd like to use HSQ, please take the stock or your own container out of the fridge and let it warm up for 30 minutes. Please do not let any moisture or foreign liquid contaminate the stock or your own solution. If water droplets come in contact with HSQ, a thick gel will form which cannot be used!**
- Please use the Eppendorf pipette (in Raith 150 room) for preparing your own formulations.
- Please use the disposable droppers (Aisle 1 and 2 drawers) for dispensing your HSQ.
- The resist thickness is dependent on the ramping scheme. During the data collection both ramping schemes (i) constant ramp rate, and (ii) constant ramp time, were used. Since MIBK evaporates rapidly, the constant ramp time method was chosen. This means that the ramp rate increases i.e., for RPM = 1000, 2000, 3000 ... and RPM = 2, 2, 2, ... , the corresponding ramp rate = 500 rpm/sec, 1000 rpm/sec, 1500 rpm/sec ...
- The fastest RPM the Headway spinner can operate is 8000 RPM. In order to access speeds beyond 4000 RPM, use RPM3 after RPM2 on the Headway spinner pre-sets. Check RPM2 after changing RPM3 to ensure that RPM2 has not changed.
- A program has been created on the Filmetrics system to measure HSQ films. In order to measure HSQ films on the ellipsometer, use the CAUCHY.MAT program and the following optical constants as starting parameters (check the fit constants dialog box):
 Stock 6% HSQ: Alpha = 1.392, Beta = 0.004, Gamma = 0.00003
 Dilute 1% HSQ: Alpha = 1.415, Beta = 0.004, Gamma = 0.00006

If you have any questions regarding the above, please contact Mohammad Ali Mohammad (ebi.nanofab@ualberta.ca). If you require training on the spinner, please contact the qualified trainers mentioned in the Headway resist spinner SOP. Should none of the above contacts be available, please contact any staff member for assistance.