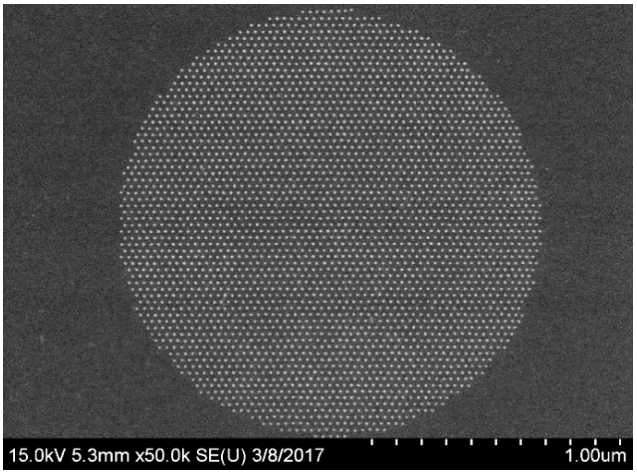
AQM HSQ / H-SiO_x

H-SiO_x is a high purity, silsesquioxane-based solid with a long shelf life (>1 year when stored correctly). It is soluble in most organic solvents (e.g., anisole, *n*-butyl acetate, hexanes, methyl isobutyl ketone [MIBK], 2-propanol, toluene, xylenes). H-SiO_x is commonly dissolved in MIBK, but carrier solvent investigations by AQM support an increased shelf-life in *n*-butyl acetate. H-SiO_x solutions are dispensed onto substrates/wafers and dispersed via spinning. After spinning, a film of H-SiO_x remains that can be used as a resist or spin-on dielectric. H-SiO_x can be used in electron beam (EB), extreme ultraviolet (EUV), and nanoimprint lithography systems.

Sufficiently dosed H-SiO_x forms a low dielectric constant (low-κ) silicon-rich oxide that is resistant to removal by hydroxide-based developers, such as tetramethylammonium hydroxide (TMAH) (e.g., MF-319, MF-CD-26) and Salty Developer (NaOH/NaCl).

AQM is constantly synthesizing, testing, and improving its H-SiO_x to meet and exceed customers' expectations (since 2017). AQM has distributors located in the United States (DisChem Inc.), Europe (EM Resist Ltd), China (GT Nano), Japan (OptoSirius), and Korea (HunetPlus).



Lithography features:

- Thin uniform films (5 nm – 2 μm thickness)
- High resolution (capable of ≤10 nm patterning)
- Excellent line edge roughness
- Good dry-etch resistance

Other Applications:

- Photoresist for mask making.
- Mask for etching, e.g. Si, SiO_2, Si_3N_4 or metals.
- Silicon-based photonics – waveguide components, grating couplers, and photonic crystals.
- Generation of stamps with nanopatterns.

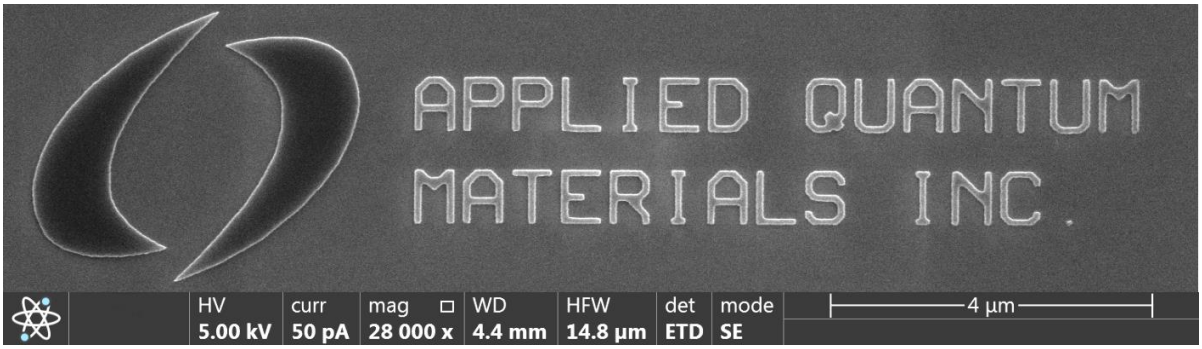


Figure 1. SEM image of an AQM logo (~13.5 µm wide, ~80 nm thick layer) exposed at 400 µC/cm^2 (RAITH150 Two at 30 kV, 15 µm aperture), developed in MF-319 for 90 seconds, and then rinsed with deionized H_2O for 60 seconds. Taken at the UofA nanoFAB.

Purchasing:

AQM H-SiO_x solid can be purchased separately or in a resist kit containing solid, HPLC grade *n*-butyl acetate (≥99.7) or MIBK (≥99.5%), syringes, and PTFE filters.

H-SiO_x solutions can be made to standard 1, 2, 4, 6 or custom weight percentages. For best results, it is recommended that freshly opened HPLC grade *n*-butyl acetate or MIBK is used. AQM is currently developing a line of developer solutions: Salty Developer (NaOH/NaCl); TMAH (various concentrations). Contact us for details and pricing.

Examples of H-SiO_x solutions available:

Solution w/w	*n*-Butyl Acetate	H-SiO_x
1 %	25.0 mL	0.223 g
6 %	17.8 mL	1.00 g
6 %	25.0 mL	1.41 g
20 %	4.5 mL	1.00 g
20 %	5.0 mL	1.10 g

Solution w/w	MIBK	H-SiO_x
1 %	25.0 mL	0.202 g
6 %	19.6 mL	1.00 g
6 %	25.0 mL	1.28 g
20 %	5.0 mL	1.00 g

Solutions should be made with high accuracy measuring instruments (do not use glass) so that coating thicknesses are consistent.

Shelf-Life and Storage:

- Solid: at least 1 year when stored in a vacuum (≤30 mmHg) at ambient temperature in leakproof HDPE bottles.
- Dissolved in *n*-butyl acetate: greater than 6 months (estimate: 18 months) when contained in a sealed HDPE bottle, kept in a low-moisture environment at room temperature.
- Dissolved in MIBK: at least 3 months when contained in a sealed HDPE bottle, kept in a low-moisture environment at room temperature.
- Solutions: Shelf-life may be extended by storing at significantly lower temperatures, such as a -20°C freezer, or colder. Containers should never be opened below room temperature.