

HSQ Negative EBL Resist

Introduction to HSQ and ongoing developments for securing supply

MAEBL 2020 Session 2, August 27, 2020

Andy Thompson, DisChem, Inc.



DisChem

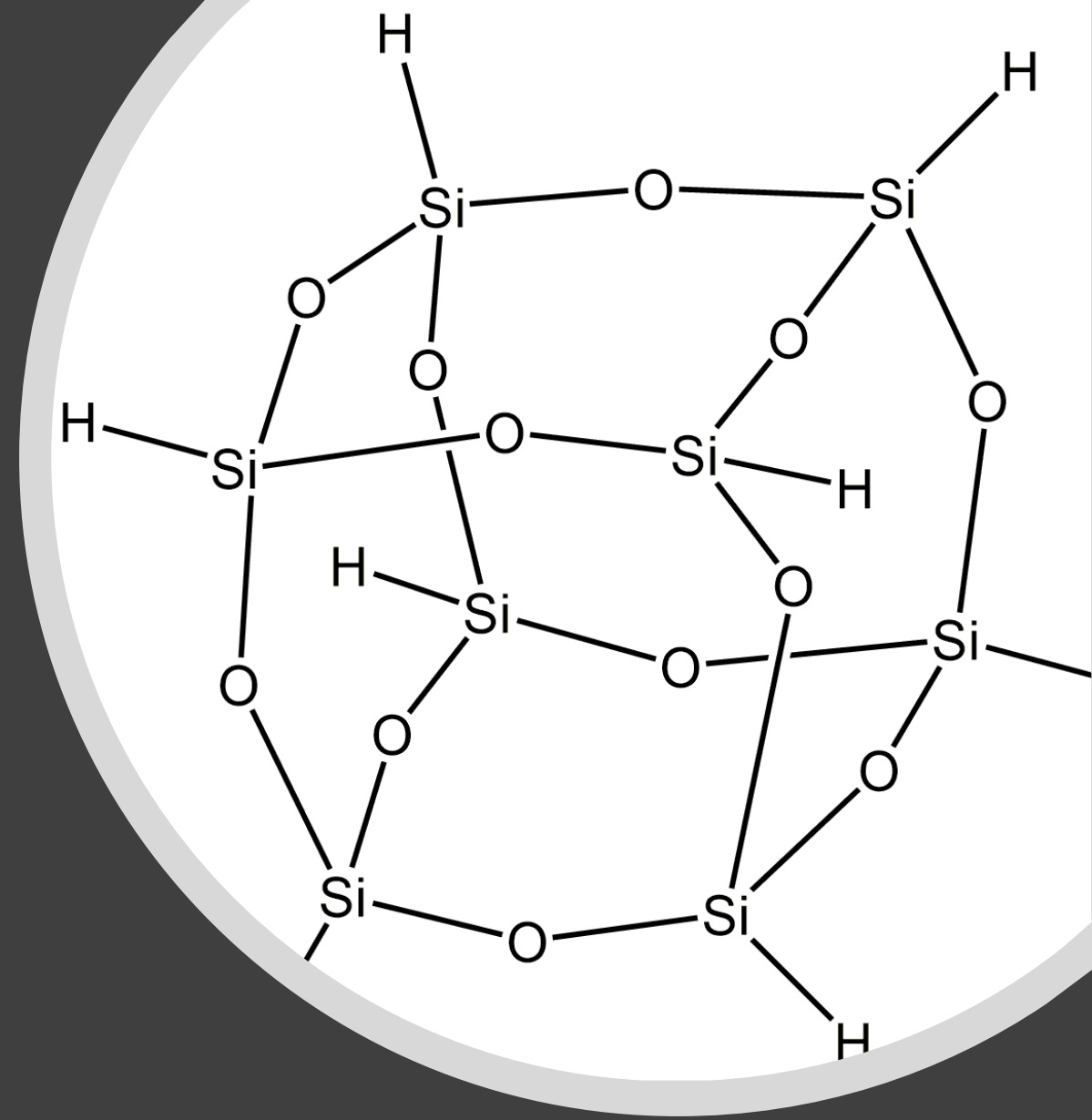
CHEMISTRY FOR
ADVANCED LITHOGRAPHY



**Applied Quantum
Materials Inc.**

HSQ: What is it and why is it important for electron beam lithography

- Hydrogen silsesquioxane (HSQ) derived through hydrolysis of silane compounds
- High resolution achievable using EBL and EUV lithography at wavelengths below 157 nm
- Cubic and chain molecular structure allows for thick films
- Few suitable negative tone EBL resists candidates



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History and Supply Chain Issues

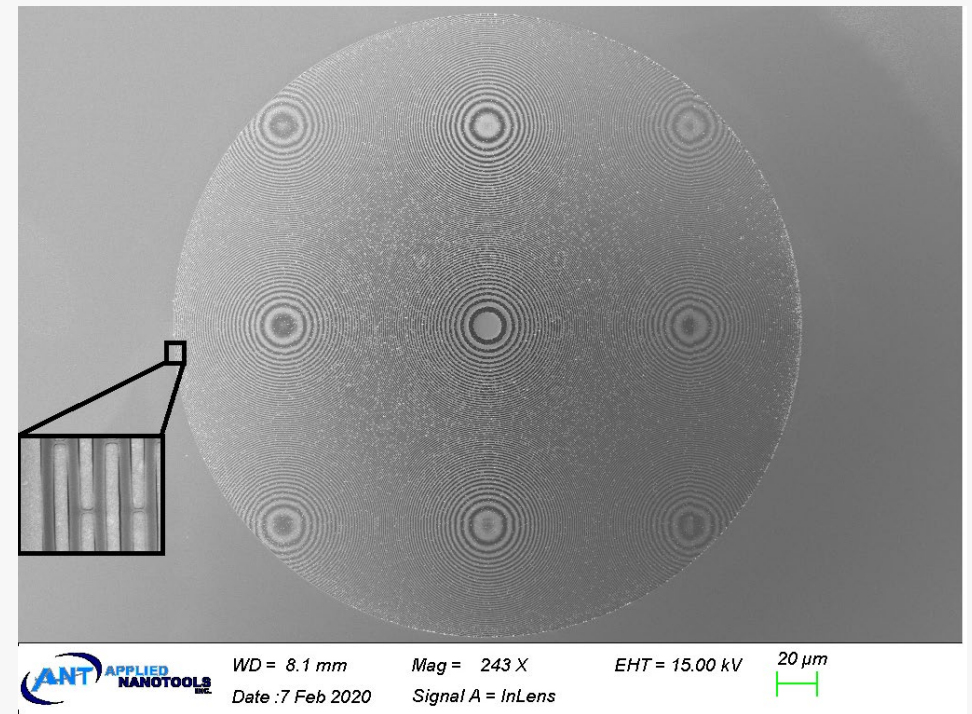
- HSQ has been supplied almost exclusively by DOW-Corning Chemical
- DOW XR1541 series HSQ is widely used by the EBL community as a standard negative tone resist
- Temperature sensitive with short shelf life (6 months at -5C)
- Lead times of up to 4 months
- Uncertain of future availability
- New opportunities for alternate supply chains

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Investigation of Alternatives: H-SiO_x Dry Silicon Resins

- Dry silicon resins (H-SiO_x) derived by hydrolysis and precipitation of organic silanes
- Polymer highly soluble in MIBK for formation of HSQ compounds
- Characterized by excellent pitch resolution (6 nm), sensitivity, LER (2 nm) and etch resistance for thin film EBL applications.
- Readily available as H-SiO_x



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DisChem / Applied Quantum Materials Partnership for Delivering HSQ to the EBL Community

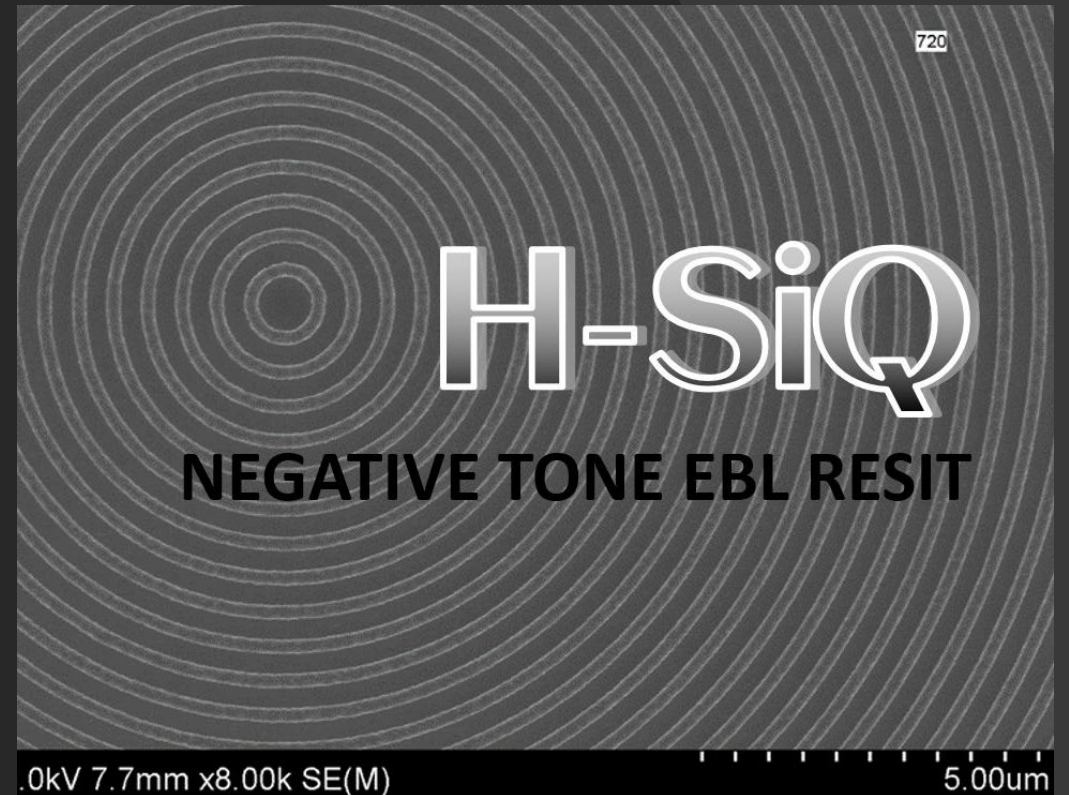
- Combining Expertise: DisChem's experience in developing, marketing and distributing novel chemical solutions for advanced lithography with AQM's leadership in synthesizing silicon polymers for use in fabricating nanomaterials.
- Reliable supply chain with on-demand turn around.
- North American based (USA/Canada). Meets the National Nanotechnology Coordinating Infrastructure (NNCI) for sourcing critical materials from member countries.

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Introducing H-SiQ: Negative tone HSQ Resist derived from H-SiO_x dry silicon resin

- Performance comparable to XR1541 resist using same processing parameters
- Made on demand from H-SiO_x dissolved in semiconductor MIBK
- Typically ships with 48 hours with 100% shelf life.
- Customizable: available is standard 2, 4 and 6% wt/vol. or up to 25% concentrations
- Currently available in USA and Canada for research applications
- Research ongoing...



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