EM RESIST LTD
SPECIALISTS IN RESIST TECHNOLOGY

Media House
Adlington
SK10 4NL
United Kingdom
+44 (0) 1625 813723
info@emresist.com

HSQ Resist – Datasheet

Features

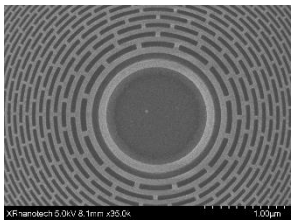
Solution Concentrations:

1 – 45%

Excellent line edge roughness

High Resolution

Customisable solutions



Introduction

Hydrogen silsesquioxane (HSQ), with a chemical formula of HSiOx, is a high purity, silsesquioxane-based semiconductor grade polymer applicable as a negative tone resist for electron beam patterns, EUV, nanoimprint lithography and Step and Flash Imprint Lithography (SFIL). It is readily soluble in non-polar organic solvents like methyl isobutylketone (MIBK) and n-butyl acetate for thin-film fabrication. Depending on the film thickness, a dense pattern with sub-10 nm half pitch can be achieved.
The resist can be supplied in liquid form, powder form or in a self-dilution kit.

Processing Conditions

Substrate Preparation

HSQ can be spun on a range of substrates without adhesion layers. Ensure that the substrate is clean and dry. Substrate cleaning can be performed using solvents, O_2 Plasma and O_3.

Powder Dilution

If your HSQ has been supplied in powder form, dilution needs to be performed prior to substrate coating. Dilution should be performed in a clean environment with fume extraction. Mix the appropriate amount of HSQ with MIBK to obtain your desired concentration by weight. Filter the resulting solution using a 0.2µm inline filter with a syringe. A separate dilution procedure document is available.

Only use MIBK provided by EM Resist. Leave the solvent bottle open for as little time as possible and tightly close the lid after use. Limit the number of times the solvent bottle is opened and do not use MIBK after 3 months of first opening. EM Resist are not liable for any mishandling of powder HSQ, incorrect use of MIBK provided by us, or use of MIBK from other suppliers. If alternative MIBK is sourced by the end user, ensure it is HPLC grade (>99.5%) or better and <0.02% water content (check the batch's CoA).

Coat
EM Resist HSQ products are coated on the substrate using a spin coating process. The film thickness spin curves of representative HSQ solutions are displayed below. These provide the information required to select the HSQ dilution for the desired film thickness and spin speed.

Ensure that refrigerated resist solutions are allowed to equilibrate to room temperature prior to opening. Failure to do so will result in water condensation inside the bottle, which may spoil the resist.

Dispense the solution onto the substrate. Use a 2 second ramp time to ramp up to the desired spin speed then hold for 40 seconds.

Soft Bake
Hotplate: 150°C for 120 s

Exposure
Electron beam lithography: Dose 400 – 700µC/cm^2 depending on electron source, equipment, exposure energy and developer used.

Post Exposure Bake
A post exposure bake at 350°C or higher temperature in N_2 can enhance the contrast properties of the film.

Develop
HSQ films can be developed using any standard aqueous base developer such as 0.26N TMAH for 70 seconds.

Rinse and Dry
Upon completion of the development process , the resist should be rinsed with flowing DI water to prevent scumming. Substrates can be spin dried at 3000rpm for 20s or blow dried with a dry, inert gas (typically N_2).

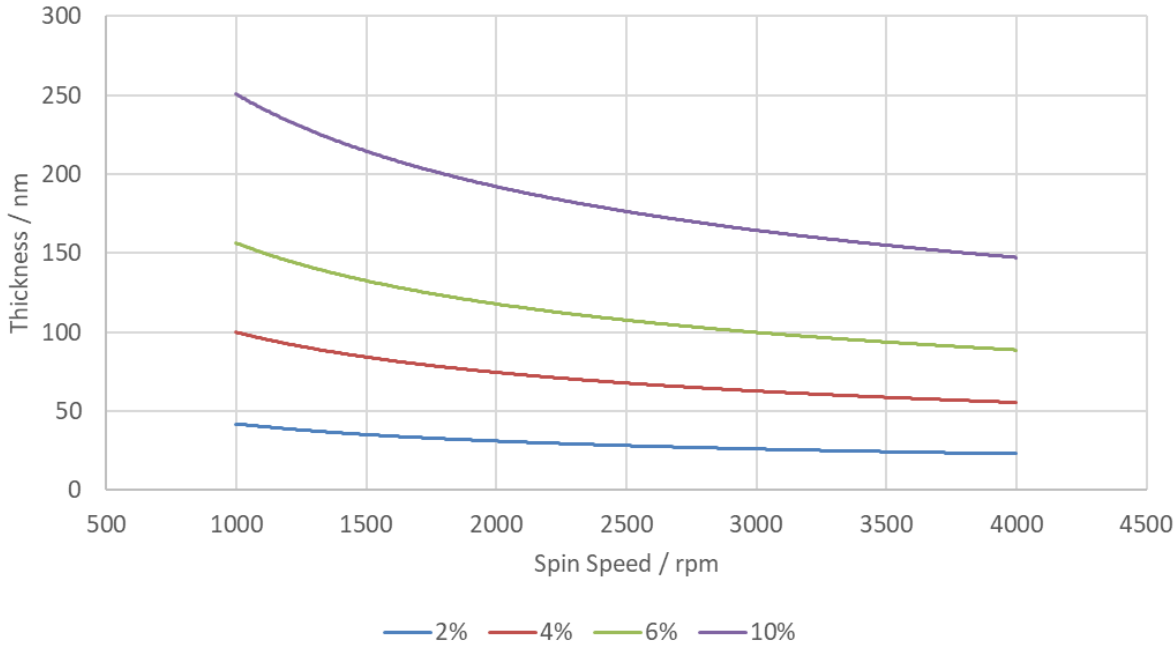
Removal techniques
After exposing HSQ resist, the film is converted to silicon dioxide, therefore HSQ can be removed with hydrofluoric acid (HF) or buffered oxide etch (BOE).

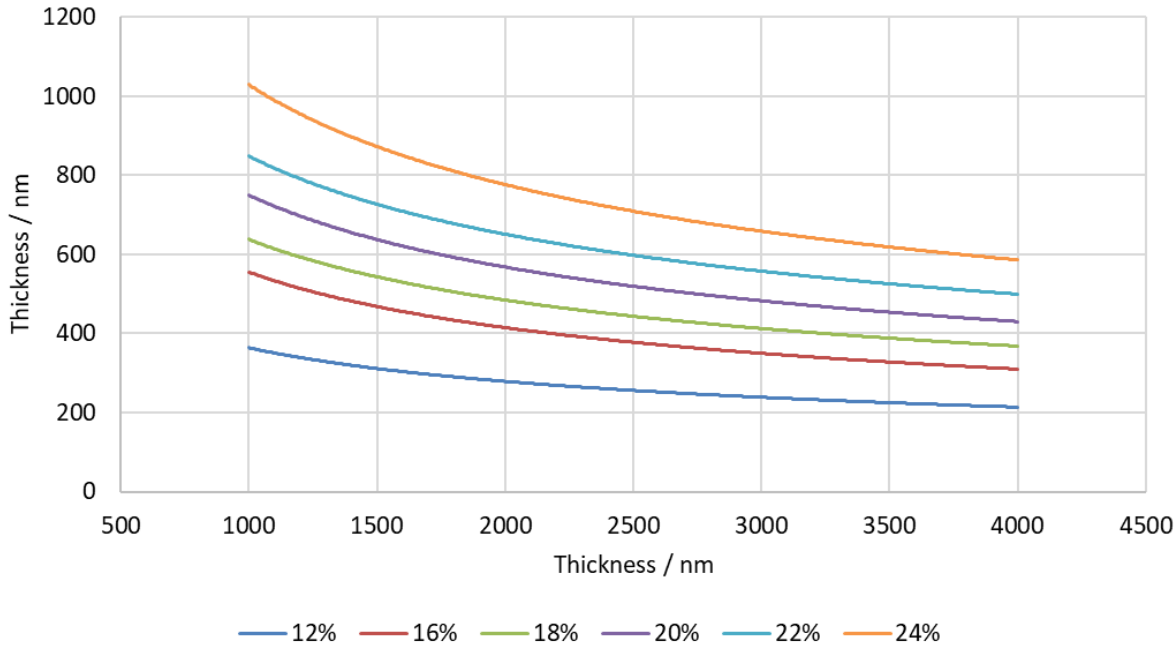
Shelf-life and Storage
In powder form, HSQ can be kept for at least 1 year at room temperature providing it is stored under dry ambient conditions in the absence of light, and ideally in a vacuum desiccator. Do not store HSQ solid or liquid in glass containers as this will cause irreversible gelation of the product.

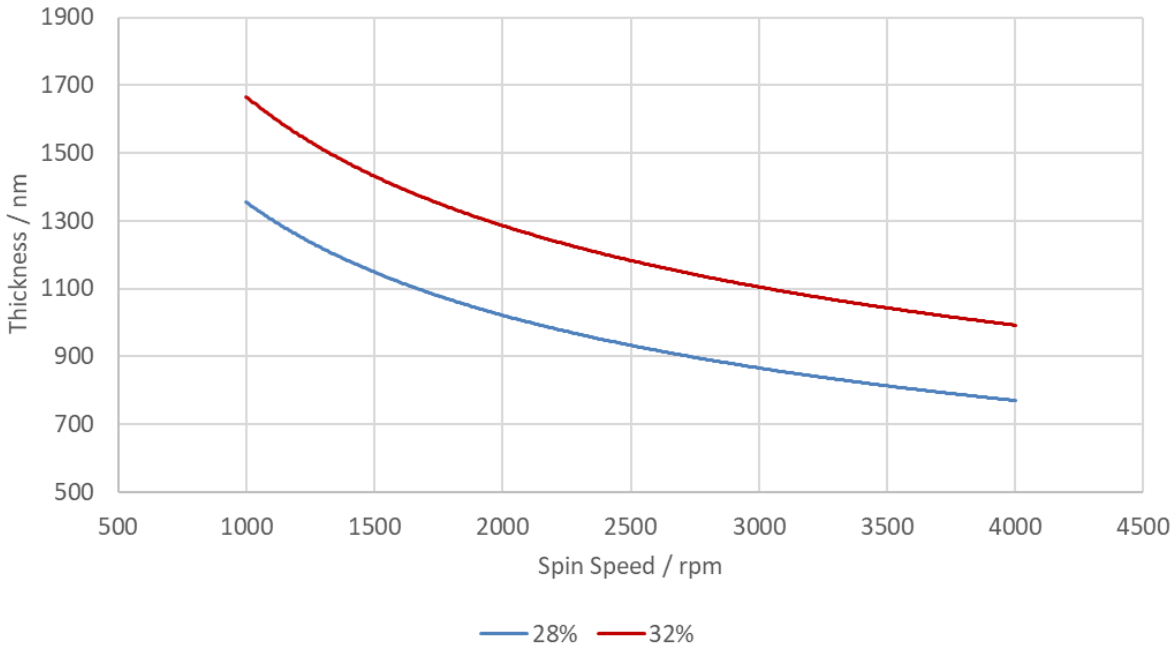
When in solution, HSQ has a shelf life of 3 months when stored below 5°C.

Spin Curves

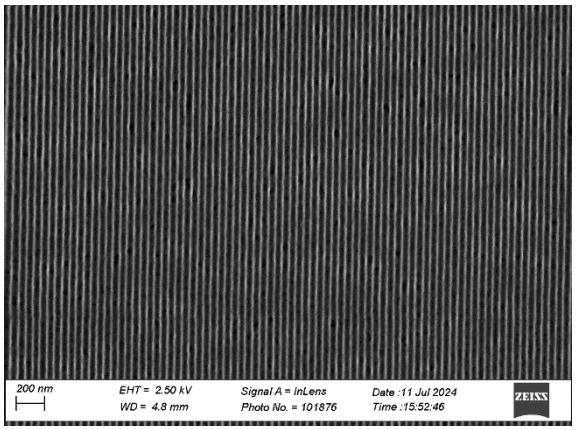
The spin curves shown below are for HSQ solutions in MIBK solvent. They show the film thickness that is obtained based on the spin speed that is selected. This data provides approximate information to allow for the selection of the correct product/dilution for your application and desired film thickness. Actual results will vary based on equipment, environment, process conditions and application. Additional dilutions are available upon request.



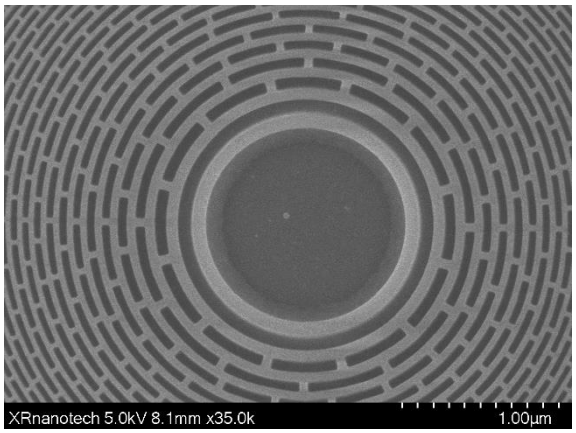




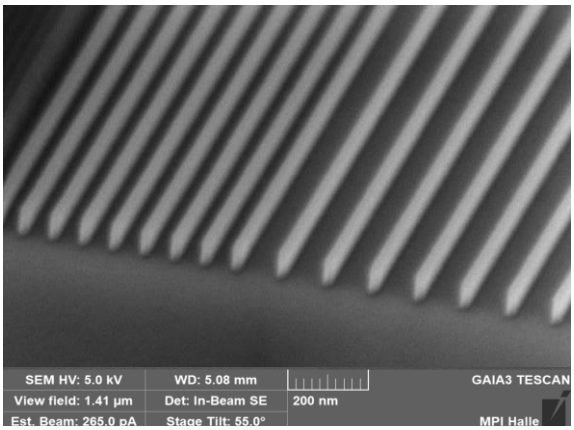
Applications Data



Paul Scherrer Institut – Dr. Kevin Hofhuis – 2% Solution



XRnanotech – Dr. Damien Eschimese – 20% Solution



Max Plank Institute - Halle – Dr. Jiho Yoon – 6% Solution