HSQ Resist - Product Information

Introduction
SiOx 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), methyl siloxane and toluene 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.

- Direct write of thin uniform films
- High resolution (<10 nm)
- Excellent line edge roughness
- Good dry etch resistance

- Available in powder or liquid form
- Customisable solutions
- Very long shelf life in powder form at 20°C
- Very high thermal stability

For more information or to enquire about products, please call or email us.

+44 (0)1625 704465    info@emresist.com    www.emresist.com

EM Resist, Alderley Park, Alderley Edge, Cheshire, SK10 4TG
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 under a fume cabinet. 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.

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 open for, 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 supplier. If alternative MIBK is sourced by the end user we recommend HPLC grade (>99.5%) or better and <0.02% water content (check the batch’s CoA).

Detailed handling and dilution instructions can be found on the HSQ Dilution Process document.

Coat

EM Resist HSQ products are coated on the substrate using a spin coating process. The film thickness spin curves for our most common dilutions are displayed below. These provide the information required to select the HSQ dilution for the desired film thickness.

Ensure the resist comes to room temperature prior to opening, failure to do so will result in condensation forming spoiling 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.

Pre Bake

Hotplate: 150°C for 120 s

Exposure

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Electron beam lithography: Dose 400 – 700µC/cm² depending on electron source, equipment, exposure energy and developer used.

**Post Exposure Bake**

A 350°C post exposure bake in N₂ can enhance the contrast properties of the film.

**Develop**

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

**Rinse and Dry**

Upon completion of the development process and to prevent scumming, the resist should be rinsed with flowing DI water. Substrates can be spin dried at 3000rpm for 20s or blow dried with a dry, inert gas (typically N₂).

**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 providing it is stored under dry ambient conditions in the absence of light, and ideally in a vacuum dessicator. Do not store HSQ in glass containers as this will cause irreversible gellation of the product.

When in solution with MIBK, HSQ has a shelf life of 3 months. It must be stored below 5°C.

For any technical assistance please contact Technical Services.
Spin Curves

The spin curves shown below are for HSQ in MIBK. 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.

HSQ in MIBK

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