DisChem
CHEMISTRY FOR ADVANCED LITHOGRAPHY

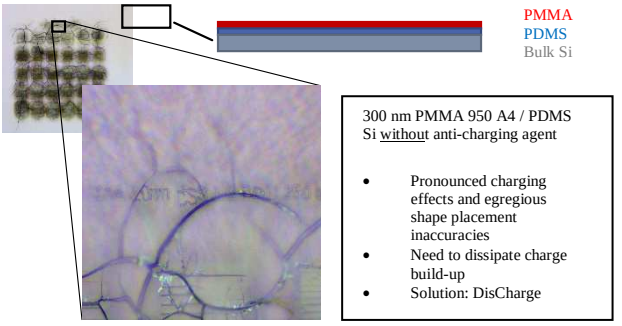
DisCharge+

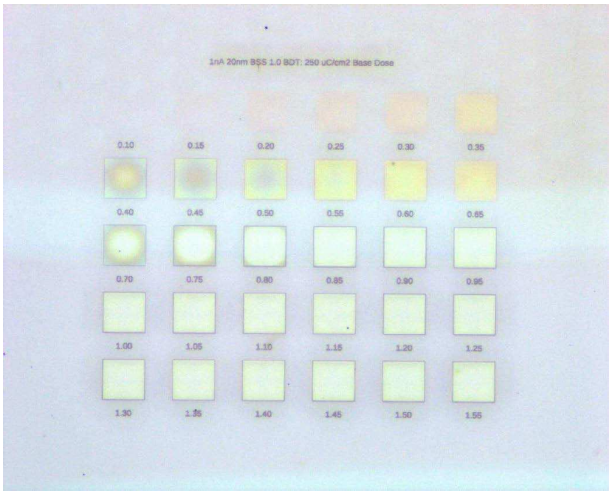
ELECTRON BEAM LITHOGRAPHY ANTI-CHARGING AGENT

DisCharge H20 is an advanced water borne anti-charging agent for use in electron beam lithography (EBL) on non-conductive substrates. DisCharge is applied directly atop an EBL resist on insulated materials to create a conductive film that effectively dissipates electrons to prevent charge accumulation. The DisCharge film is easily removed by water or isopropyl alcohol and is residue free after EBL exposure.

The DisCharge H2O Advantage

- Efficient charge dissipation in EBL on a broad range of resist materials (PMMA, HSQ, mr-PosEBR, CSAR 62, ZEP 520A, SML).
- Improved shape fidelity and positional accuracy of EBL patterns in resist on insulated substrate materials such as SiO_2, fused silica, quartz, PDMS, etc.
- Water based formulation with excellent wetting properties.
- Simple spin coat application.
- Easy residue free removal by water or IPA rinse.
- Competitively priced. Idea for both research and industrial applications.
- Two year shelf life at room temperature. Highly stable permanently charged non-polymer formulation. No filtration required prior to use.





With DisCharge, no charge accumulation is observed. The structure appears as expected with no harm to PDMS from sudden dielectric breakdown.

DisCharge is available in standard (DisCharge H20), 2X (DisCharge H20x2) and 4X (DisCharge H2Ox4) concentrations to allow for greater control of film thickness and sheet resistance. The standard concentration of DisCharge H2O is suitable for most applications and provides a film thickness of 40 nm at 1000 rpm coating speed. **Do not dilute DisCharge as precipitation many occur**.

DisCharge H2O is effective on a broad range of EBL resist, including PMMA, HSQ, CSAR 62, ZEP 520A, SMLand mr-PosEBR. DisCharge H2O is not recommended for use with ma-N 2400 resist.

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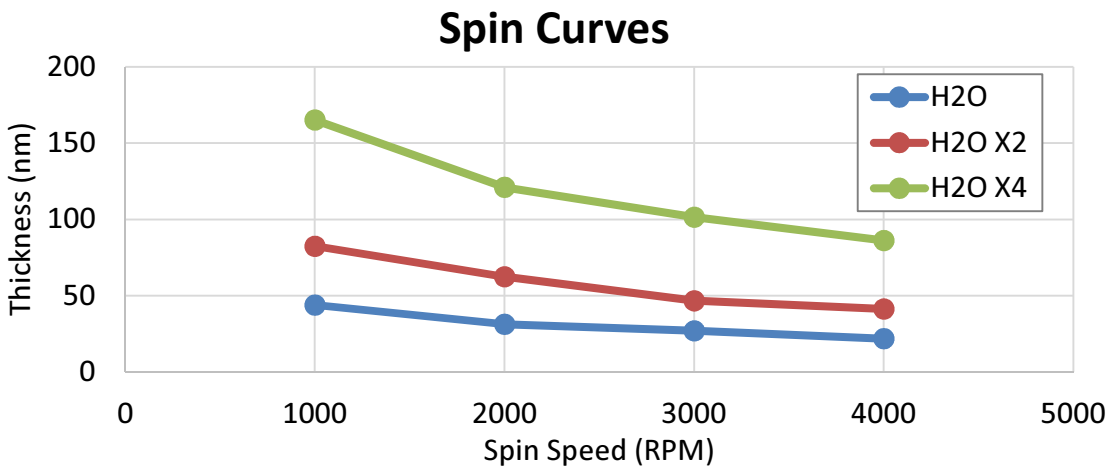
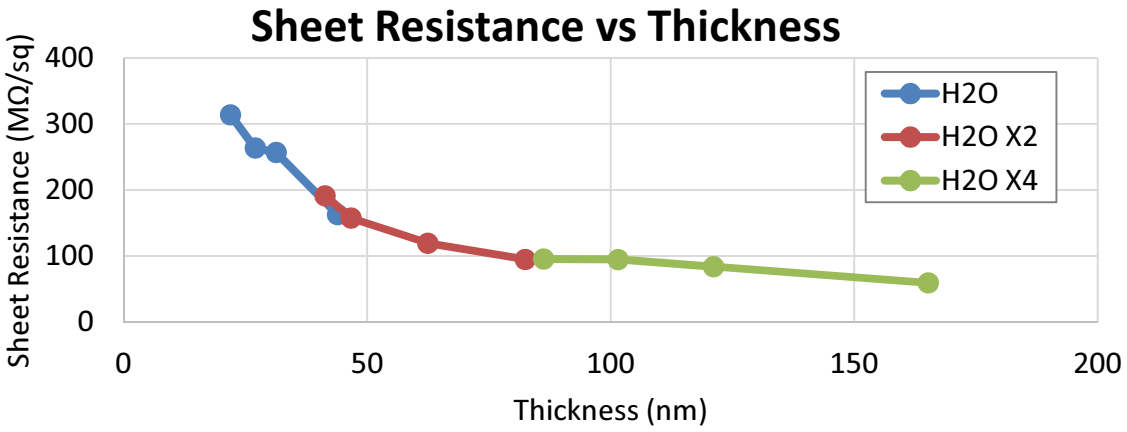




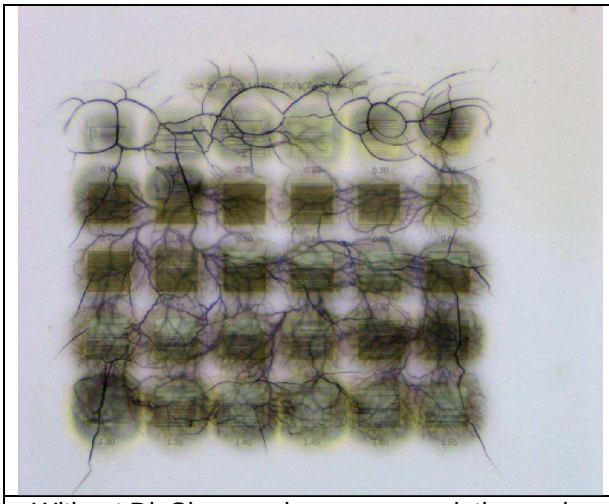
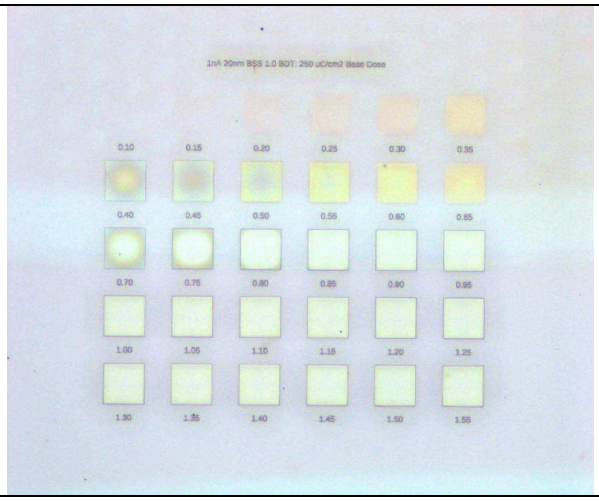
DisCharge H2O Application and Removal

1. Spin coat and pre-bake the resist per the manufactures protocol.
2. Allow the wafer / sample to cool to room temperature.
3. Generously coat the resist with DisCharge to cover approximately 2/3^{rds} to 3/4^{ths} of the sample.
4. Spin coat the DisCharge for 30-60 seconds to achieve the desired thickness per the spin curve diagram above. Do not soft bake after spin coating. The DisCharge film should have a gloss finish and remains tacky to the touch. Avoid touching the film as it may smudge.
5. Mount the sample in the EBL tool with the grounding clip touching the surface of the sample. Expose the desired pattern.
6. After resist exposure, remove the DisCharge film by 4rinsing with water or isopropyl alcohol for 30 – 60 seconds. Thoroughly dry the sample using nitrogen blow dry.
7. Develop resist per protocol.

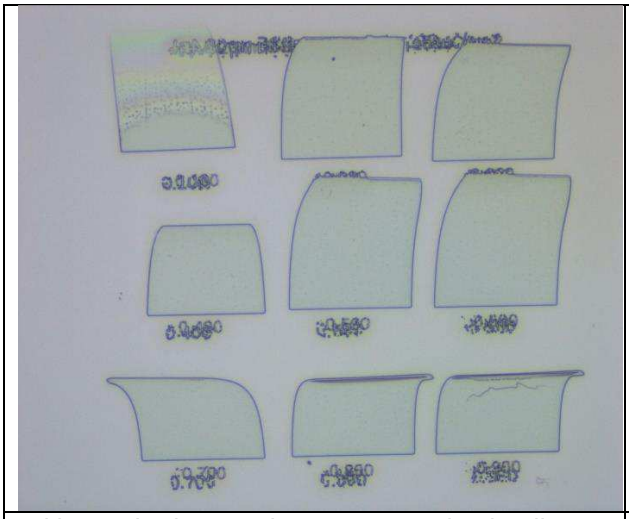
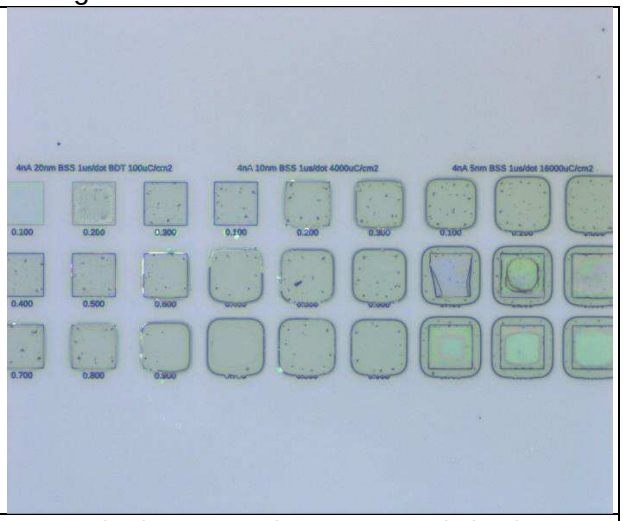
Evidence of DisCharge Anti-Charging Properties

The following images provide evidence of DisCharge as an effective tool for use as a charge dissipation agent in electron beam lithography. Exposures were performed using various resist and substrate materials using an Elionix ELS-7500EX 50keV EBL tool. The test structures consist of 60 micron squares exposed at various doses using a 20 nm beam step size (shot pitch) with a 1 nA beam current.

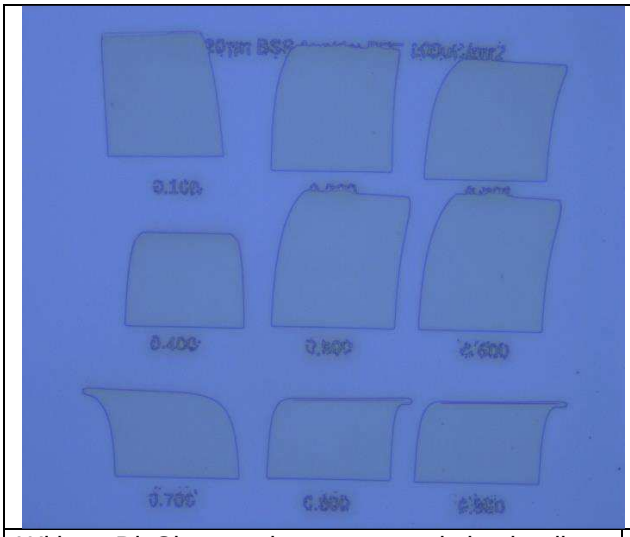
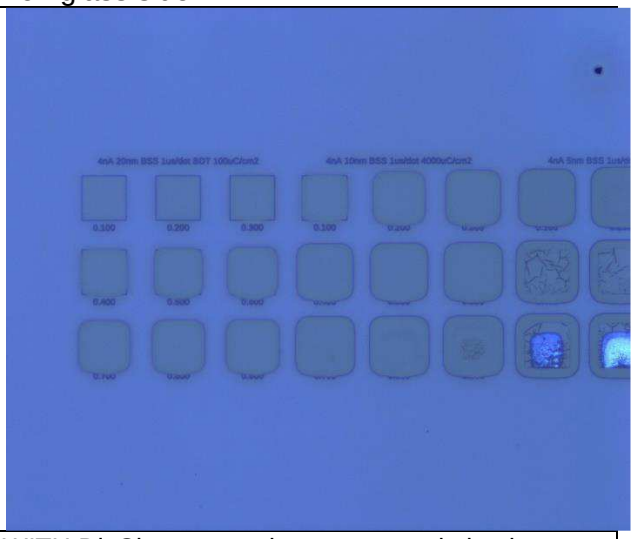
300 nm PMMA 950 A4 / 1 mm PDMS / bulk Si

		
Without DisCharge: charge accumulation and sudden charge dissipation caused by exceeding the dielectric breakdown strength of the PDMS to the Si substrate resulting in significant cracking of the resist.		WITH DisCharge: no charge accumulation, resulting in expected image with no harm to the PDMS.

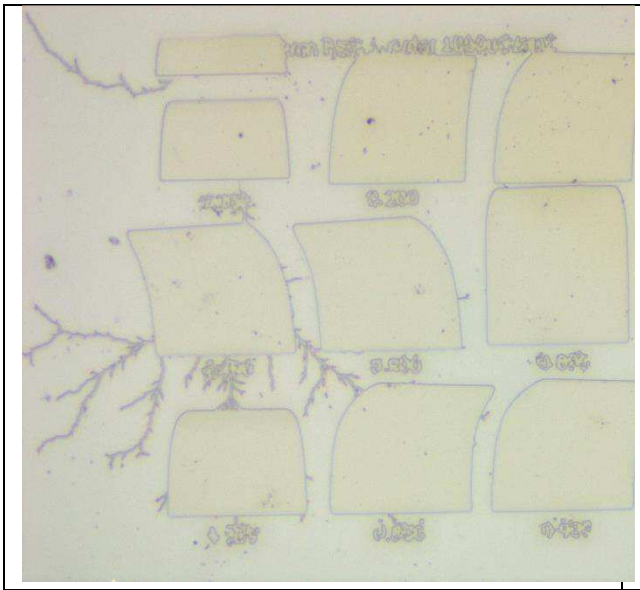
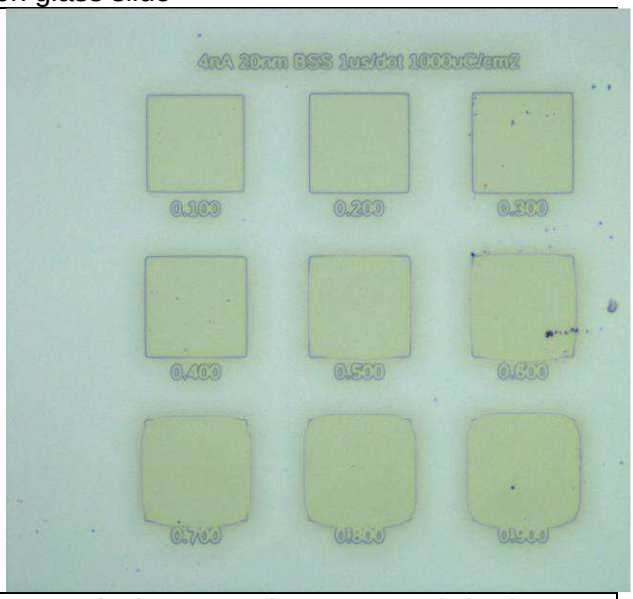
300 nm mr-PosEBR on glass slide

		
Without DisCharge: charge accumation leading to poor shape fidelity of the contrast curve pattern.		WITH DisCharge: no charge accumulation is observed. The structure appears as expected. Crosslinking of the positive resist is especially observed at high doses.

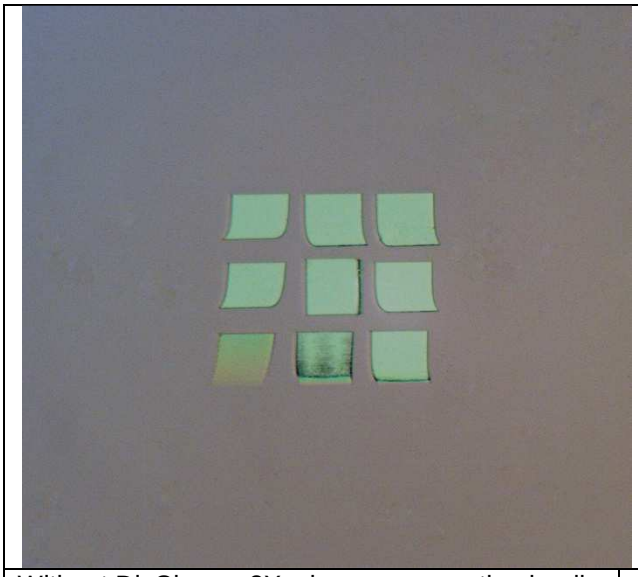
200 nm ZEP520A on glass side

		
Without DisCharge: charge accumulation leading to poor shape fidelity of the contrast curve pattern.		WITH DisCharge: no charge accumulation is observed. The structure appears as expected. Crosslinking of the ZEP520A resist is especially observed at high doses.

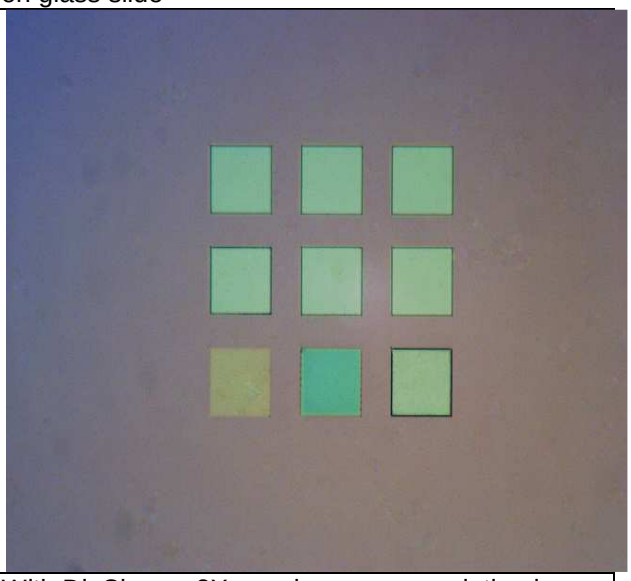
300 nm CSAR on glass slide

		
Without DisCharge: charge accumulation leading to poor shape fidelity of the contrast curve pattern.		WITH DisCharge: no charge accumulation is observed. The structure appears as expected. Crosslinking of the CSAR62 resist is especially observed at high doses.

300 nm SML300 on glass slide



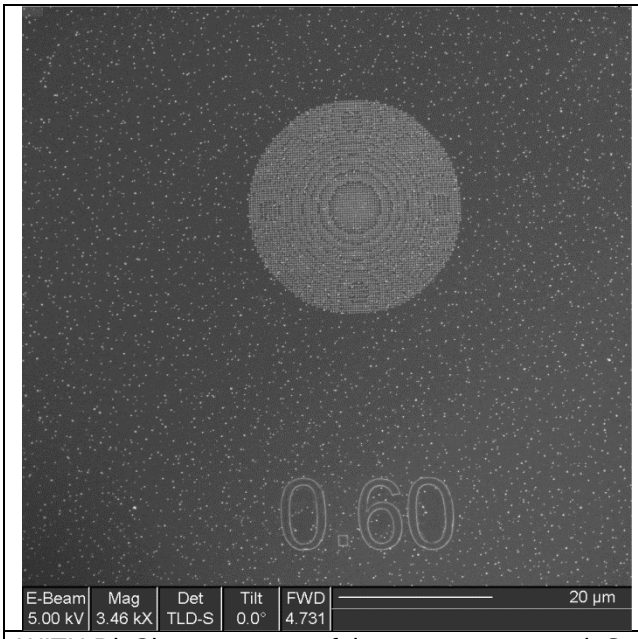
Without DisCharge 2X: charge accumation leading to poor shape fidelity of the contrast curve pattern.

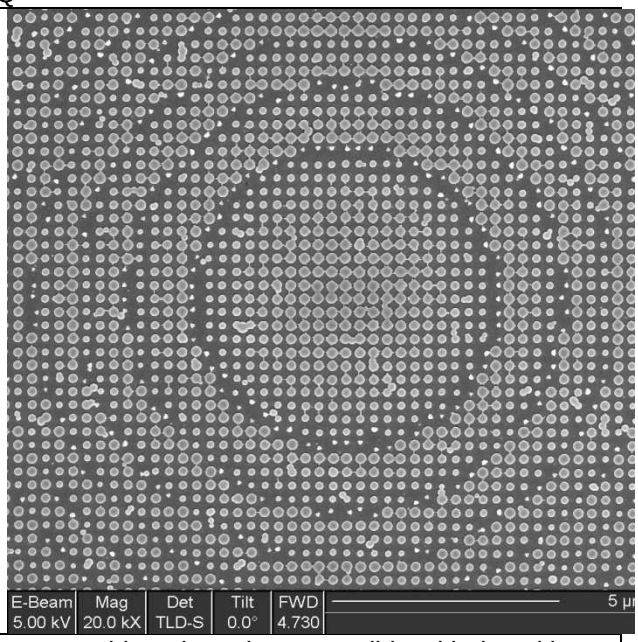


With DisCharge 2X: no charge accumulation is observed. The structure appears as expected.

Images provide courtesy of EM Resist Ltd.

HSQ



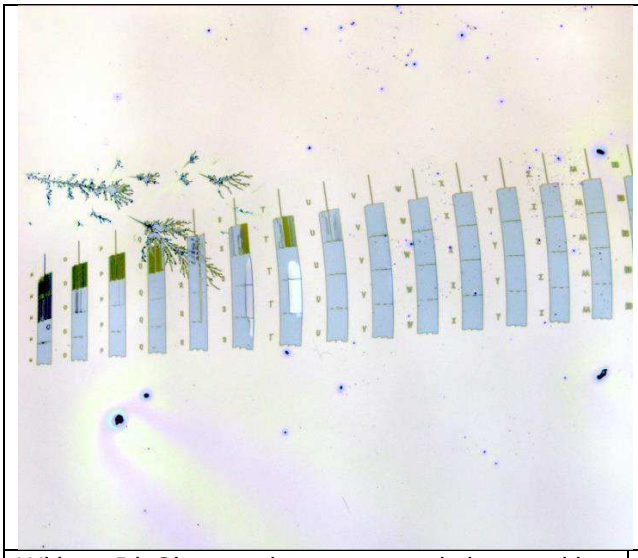
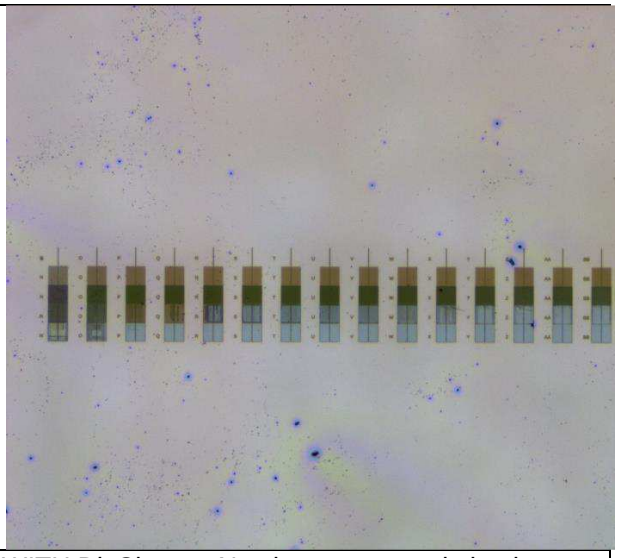


WITH DisCharge: successful structure patterned. Structure would not have been possible with the without the use of a charge dissipation agent.

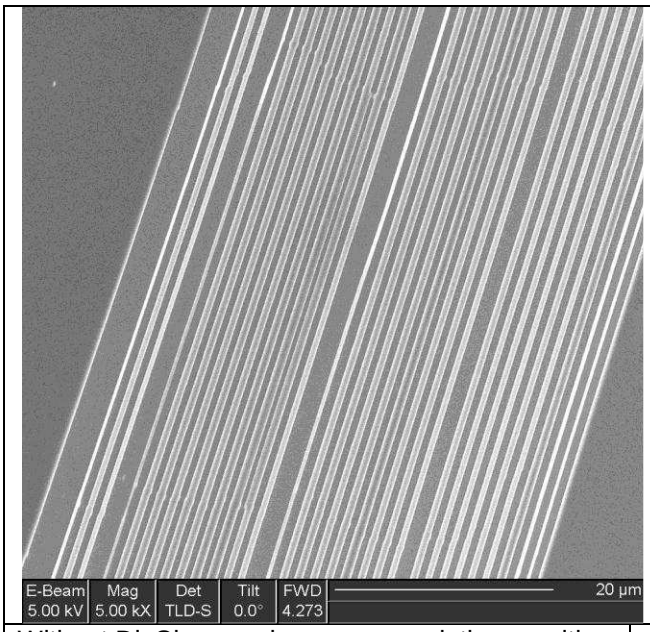
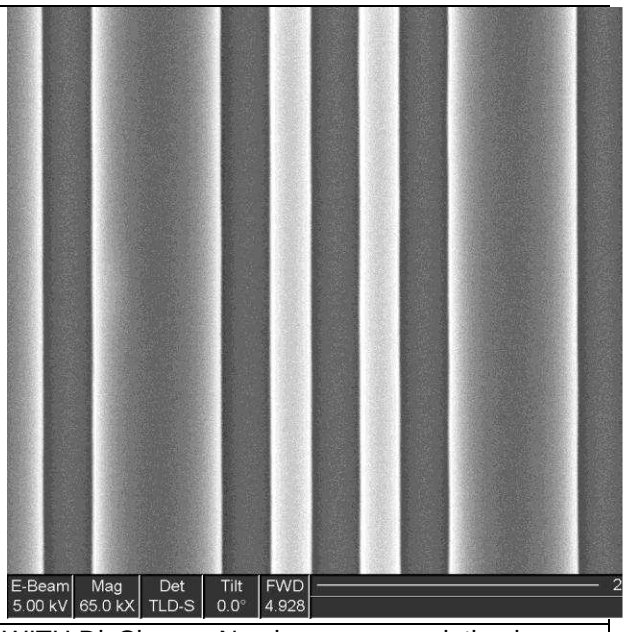
Nanoscale Impact of DisCharge

DisCharge efficacy was tested at the nanoscale using tower patterns in a dose matrix using 300 nm ZEP520A atop fused silica. The tower patterns consist of 300 nm line space patterns at various pattern densities.

300 nm ZEP520A on fused silica

	
Without DisCharge: charge accumulation resulting in poor shape fidelity of the tower pattern.	WITH DisCharge: No charge accumulation is observed. The structures appear as expected.

300 nm ZEP520A on fused silica

	
Without DisCharge: charge accumulation resulting in poor shape fidelity of the tower pattern.	WITH DisCharge: No charge accumulation is observed. The structures appear as expected.

Storage and Handling

DisCharge H2O has a two year shelf life when stored at room temperature in the original product bottle. DisCharge is provided pre-filtered to 0.2 µm. Additional filtration is not required before use. Read the product Safety Data Sheet before handling.

Product Inquires and Ordering Information

DisCharge H2O is available globally in both research and industrial quantities. Please direct technical and distribution questions to DisChem, Inc.

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DisChem
CHEMISTRY FOR ADVANCED LITHOGRAPHY

DisChem Mission Statement

DisChem is dedicated to serving the needs of advanced lithography community through innovative chemical solutions.