

# KMPR NEGATIVE PHOTORESIST PHOTOLITHOGRAPHY PROCESS (65 and 100 $\mu\text{m}$ )

## Purpose:

This KMPR photolithography process is designed for the patterning of a uniform, thick polymer layer on 4-inch silicon, silicon oxide, and silicon nitride wafers. KMPR 1025 and 1050 are negative tone photoresists designed for feature heights of 20 to 100 microns.

## Equipment:

1. Solitec Spinner and Hot Plate
2. Karl-Suss MA4

## Materials:

1. KMPR 1025 (65  $\mu\text{m}$ ) or KMPR 1050 (100  $\mu\text{m}$ ): negative-tone photoresist
2. CD-26: typical photoresist developer

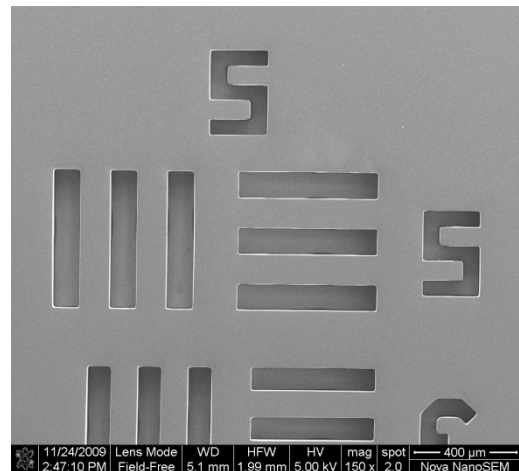
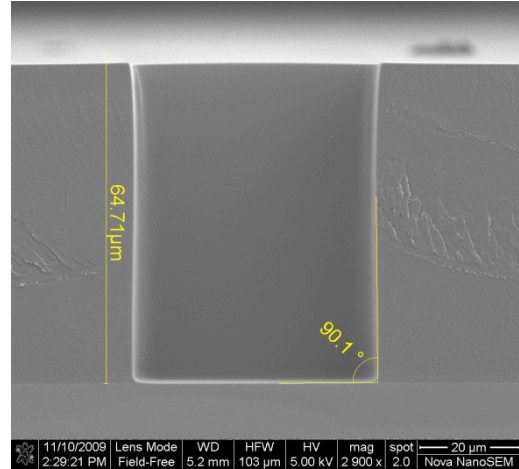
## Process:

1. If using a new wafer, proceed to step 2. If re-using an old wafer, clean with a Piranha etch, then rinse with DI water and dry with a nitrogen gun.

2. Bake out the wafer on an open-faced hot plate for 10 minutes at 200°C, to remove the adherent layer of water molecules.

3. Remove the wafer from the hot plate and let it cool for 30 seconds. With the wafer already on the Solitec Spinner, dispense approximately 4 mL of either KMPR 1025 (for 65  $\mu\text{m}$  features) or KMPR 1050 (for 100  $\mu\text{m}$  features). Keep the pool of photoresist centered on the wafer, and avoid the formation of bubbles at all costs.

4. For the remaining steps in the process, consult Table 1. For feature heights other than 65 or 100 microns, consult the KMPR data sheet.



Feature height	65 microns (KMPR 1025)	100 microns (KMPR 1050)
Spread speed <sup>a</sup>	Spin on the Solitec Spinner at 500 rpm for 15 seconds	Spin on the Solitec Spinner at 500 rpm for 15 seconds
Spin speed	Spin on the Solitec Spinner at 1300 rpm for 30 seconds	Spin on the Solitec Spinner at 1300 rpm for 30 seconds
Soft bake <sup>b</sup>	95°C for 16 minutes on an open-faced, level hot plate	95°C for 25 minutes on an open-faced, level hot plate
Exposure <sup>c</sup>	640 mJ/cm <sup>2</sup> at “i line” (29.1 seconds of CI-1 option on the Karl-Suss MA4)	791 mJ/cm <sup>2</sup> at “i line” (Multiple exposure: 2x18.0 seconds of CI-1 option on the Karl-Suss MA4)
Post-exposure bake <sup>d</sup>	95°C for 4 minutes on an open-faced hot plate	95°C for 6 minutes on an open-faced hot plate
Develop <sup>e</sup>	Submerge and agitate in CD-26 for about 4 minutes, then in DI water for 20 seconds. Dry with a nitrogen gun	Submerge and agitate in CD-26 for about 10 minutes, then in DI water for 20 seconds. Dry with a nitrogen gun
Optional: Hard bake	150°C for 10 minutes on an open-faced hot plate	150°C for 10 minutes on an open-faced hot plate

Table 1: Process details for 65 and 100 micron features

<sup>a</sup>It may improve uniformity of photoresist spreading and thickness if the wafer ramps smoothly from one spin speed to another, rather than jumping abruptly. For instance, it could ramp from 0 rpm to 500 rpm at 100 rpm/s to start the spread step, and then from 500 rpm to 1300 rpm at 100 rpm/s to start the spin step, and then from 1300 rpm to 0 rpm at 100 rpm/s to stop spinning.

<sup>b</sup>It may improve feature resolution if edge-bead removal is performed during the soft bake (at about 8.5 minutes through for 65 µm features or 15 minutes through for 100 µm features). After the soft bake, remove the wafer from the hot plate and let it cool for 30 seconds before proceeding to the exposure step.

<sup>c</sup>Expose the resist using the Karl-Suss MA4. Expose at CI-1, or “i line” (365 nm wavelength light). Optimum exposure energy varies with feature geometry. Furthermore, exposure energy varies with wafer composition. For silicon or silicon oxide wafers, use the dose as written. For silicon nitride wafers, use 1.5 to 2 times the written dose.

<sup>d</sup>A latent image of the features should appear after 1-2 minutes of post-exposure bake (if it appears before the post-exposure bake, then the resist has been overexposed). After the post-exposure bake, remove the wafer from the hot plate and let it cool for 30 seconds before proceeding to the development step.

<sup>e</sup>An approximate time is given because the agitation method strongly affects the rate of photoresist removal—watch the unexposed photoresist closely, and stop when it has been removed from the wafer.