KMPR 1005 NEGATIVE PHOTORESIST PHOTOLITHOGRAPHY PROCESS

Purpose:
This KMPR 1005 photolithography process is designed for the patterning of a uniform, thin polymer layer on 4-inch silicon, silicon oxide, and silicon nitride wafers. KMPR 1005 is a negative tone photoresist designed for feature heights of 4 to 10 microns.

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

Materials:
1. KMPR 1005: a negative-tone photoresist
2. CD-26: a standard 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^{o}C.
3. Remove the wafer from the hot plate and let it cool for 30 seconds. With the wafer already on the Solitec Spinner, dispense 4 mL KMPR 1005. Keep the pool of photoresist centered on the wafer, and avoid the formation of bubbles at all cost.
4. For the remaining steps in the process, consult Table 1. For feature heights other than 5 or 10 microns, refer the KMPR data sheet.

Feature height	5 microns	10 microns
Spread speed	Spin on the Solitec Spinner at 500 rpm for 15 seconds	Spin on the Solitec Spinner at 500 rpm for 15 seconds
Spin speed[a]	Spin on the Solitec Spinner at 4000 rpm for 45 seconds	Spin on the Solitec Spinner at 1000 rpm for 45 seconds
Soft bake[b]	100^{o}C for 5 minutes on an open-faced, level hot plate	100^{o}C for 5 minutes on an open-faced, level hot plate
Exposure[c]	147 mJ/cm^2 at "i line" (6.7 seconds of CI-1 option on the Karl-Suss MA4)	211 mJ/cm^2 at "i line" (9.6 seconds of CI-1 option on the Karl-Suss MA4)
Post-exposure bake[d]	100^{o}C for 2 minutes on an open-faced hot plate	100^{o}C for 2 minutes on an open-faced hot plate
Develop[e]	Submerge and agitate in CD-26 for 3 to 4 minutes. Rinse by spraying with DI water for 20 seconds. Dry with a nitrogen gun	Submerge and agitate in CD-26 for 3 to 4 minutes. Rinse by spraying with DI water for 20 seconds. Dry with a nitrogen gun
Optional: Hard bake	150^{o}C for 10 minutes on an open-faced hot plate	150^{o}C for 10 minutes on an open-faced hot plate

Table 1: Process details for 5 and 10 micron features

[a]These spin speeds were taken from the KMPR data sheet. However, lab results indicate that these spin speeds yield the desired feature height only approximately.

[b]After the soft bake, remove the wafer from the hot plate and let it cool for 30 seconds before proceeding to the exposure step.

[c]Expose the resist using the Karl-Suss MA4. Expose at CI-1, or "i line" (365 nm wavelength light). 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.

[d]A latent image of the features should appear about half-way through the post-exposure bake. 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.

[e]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.