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KMPR Master Fabrication Protocol

Justin Wen

University of Pennsylvania, jwen@seas.upenn.edu

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KMPR Master Fabrication Protocol

Abstract
Protocol for coating and exposing KMPR photoresist

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KMPR Master Fabrication Protocol

Updated on 3/25/2016

Table of Contents

1. Materials
2. Equipment
3. Protocol

Materials

- KMPR-1050
- SU-8 (KMPR) developer
- 3 inch diameter silicon wafers
- Acetone
- Isopropyl alcohol (IPA)
- PDMS/PDMS Curing Agent

Equipment

- Spin Coater
- Hotplate
- ABM mask aligner
- Vacuum Chamber
Protocol

Resist Spinning

1. Bake wafer at 200°C for 10 minutes
2. Set spin parameters:
   a. Step 1 of 2: 500 rpm, accel = “100”, 30 sec
   b. Step 2 of 2: Refer to KMPR data sheet to determine the spin speed necessary for desired thickness, 30 sec (Figure 1)
3. Position and center wafer on spinner chuck
4. Pour KMPR photoresist without air entrapment in the center of the silicon wafer
5. Spin the wafer
6. If performing multiple spins, wipe spinner hood between wafers to prevent excess KMPR from dripping onto samples

Figure 1. Spin speed vs. Thickness for KMPR® 1000 resists (21°C US & EU)
Soft Bake

1. Refer below to KMPR data sheet for appropriate soft bake time (Table 2)

<table>
<thead>
<tr>
<th>THICKNESS</th>
<th>SOFT BAKE TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>minutes @ 100°C</td>
</tr>
<tr>
<td>5 - 11</td>
<td>5</td>
</tr>
<tr>
<td>12 - 20</td>
<td>7</td>
</tr>
<tr>
<td>21 - 30</td>
<td>12</td>
</tr>
<tr>
<td>31 - 55</td>
<td>15</td>
</tr>
<tr>
<td>56 - 80</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 2. Soft Bake Times
Exposure

1. Start the ABM UV lamp (channel A)
   a. Allow at least 20 min for lamp to warm up
2. Calculate the necessary exposure time
   a. Refer to KMPR data sheet for necessary exposure energy (Table 3 & 4)
   b. The power output of the UV lamp can be found in the Power Output log in the ABM Operating Procedure binder
   c. Exposure Time = Exposure Energy ÷ Power Output
3. Position wafer and photomask
4. Bring wafer into contact with Omega Optical filter or glass blank with WEC engaged
5. Expose wafer

<table>
<thead>
<tr>
<th>THICKNESS</th>
<th>EXPOSURE ENERGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>microns</td>
<td>mJ/cm²</td>
</tr>
<tr>
<td>5 - 11</td>
<td>235 - 335</td>
</tr>
<tr>
<td>12 - 20</td>
<td>355 - 485</td>
</tr>
<tr>
<td>21 - 30</td>
<td>500 - 645</td>
</tr>
<tr>
<td>31 - 55</td>
<td>665 - 1055</td>
</tr>
<tr>
<td>56 - 80</td>
<td>1070 - 1465</td>
</tr>
</tbody>
</table>

Table 3. Exposure Dose

<table>
<thead>
<tr>
<th>RELATIVE DOSE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicon</td>
<td>1X</td>
</tr>
<tr>
<td>Glass</td>
<td>1.5X</td>
</tr>
<tr>
<td>Pyrex</td>
<td>1.5X</td>
</tr>
<tr>
<td>Indium Tin Oxide</td>
<td>1.5X</td>
</tr>
<tr>
<td>Silicon Nitride</td>
<td>1.5 - 2X</td>
</tr>
<tr>
<td>Gold</td>
<td>1.5 - 2X</td>
</tr>
<tr>
<td>Aluminum</td>
<td>1.5 - 2X</td>
</tr>
<tr>
<td>Nickel Iron</td>
<td>1.5 - 2X</td>
</tr>
<tr>
<td>Copper</td>
<td>1.5 - 2X</td>
</tr>
<tr>
<td>Nickel</td>
<td>1.5 - 2X</td>
</tr>
<tr>
<td>Titanium</td>
<td>1.5 - 2X</td>
</tr>
</tbody>
</table>

Table 4. Exposure Doses for Substrates
Post-Exposure Bake

1. Place wafer on the hotplate at 100 °C for post-exposure bake
   a. 2 minutes for thickness less than 25 µm
   b. 3 minutes for thickness between 25 and 50 µm
   c. 4 minutes for thickness greater than 50 µm

Development

1. Pour just enough SU-8 developer into glass container such that the wafer will be fully submerged when placed into the bath
2. Carefully place the wafer into the bath
3. Develop in bath of SU-8 developer with periodic agitation
4. Development is complete when developer is completely clear and there are no signs of undeveloped resist coming off the surface
5. Rinse in acetone and IPA
6. Blow the wafer dry with the nitrogen gun onto a cleanroom wipe
   a. Appearance of a white film during IPA rinse indicates the resist is underdeveloped—simply place the wafer back into the developer bath to complete development

PDMS Preparation

1. Vigorously mix PDMS base and PDMS curing agent at a 10:1 ratio by weight (use scale) for about 5 minutes
   a. For sufficient coverage in a circular aluminum dish, approximately 35g of PDMS is needed
2. Pour PDMS over the fabricated master in a circular aluminum dish
3. Place the dish into the vacuum chamber and degas the mixture for 30 minutes or until all bubbles have disappeared
   a. Remaining air bubbles in surface can be ruptured by blowing on the surface
4. Place the dish into the oven or on a hotplate at 80-100 °C—curing should complete in 20-30 minutes