Chapter [4.11]

Dymax EC-Series UV Flood System

(uvflood)

(Bay 382)

1.0 Equipment Purpose

1.1 The UV Flood system is a bench-top, general-purpose exposure unit used for exposing photoresist and to cure UV light-sensitive adhesives, coatings, and inks.

1.2 Samples ranging is size from small chips to 8 by 8 inches can fit into the system. (Although the system could accommodate samples larger than 8 by 8, the average UV intensity is much lower beyond this area.)

1.3 Emulsion and glass photomasks can be used by placing them on top of resist coated wafers.

2.0 Material Controls & Compatibility

1.1 Any material that is delaminating, flaking, or particle generating is not allowed.

1.2 All photoresists, adhesives, coatings, and inks should be in soft-form. i.e. not liquid form. This prevents contamination of inside surfaces of the system.

1.3 In the event a sample with liquid-form material is present, contact Nanolab Staff to set up a pallet for holding samples.

1.4 Any material that is flammable, must be reviewed by Nanolab Staff prior to use in the system.

3.0 Applicable Documents

3.1 Revision History.

3.2 Dymax EC-Series User Guide available in NanoLab office.

4.0 Definitions & Process Terminology

4.1 Exposure Dose: Intensity integrated over time. Intensity \([W/cm^2]\) x Time [s] = Dose [J/cm\(^2\)]. The required dose is dependent on the type and thickness of material to be cured.

4.2 UVA: Ultraviolet light with wavelength ranging from 315 to 400 nm.

4.3 UV Light Shield: The light shield is located at the base of the UV Flood System and is designed to contain UV radiation inside the system. The user loads their sample into the light shield using the front loading door. The sample can be safely observed during the curing process through the UV-blocking safety glass window on the front of the light shield.

4.4 Shutter: The shutter sits above the UV Light Shield and below the Reflector Assembly Housing. It is used to control the exposure dose received by the sample.

4.5 Reflector Assembly Housing: The reflector assembly housing is the topmost portion of the UV Flood System, resting atop the shutter. It houses the UV flood lamp, reflector assembly, and ventilation fan.

5.0 Safety

5.1 All materials placed in the system that are not stocked by the Nanolab are considered Special Chemicals. Lab members must review their use of Special Chemicals with Nanolab Staff and have all chemicals approved and labeled prior to bringing them into the NanoLab. See Nanolab Chemical Hygiene Plan section 5.0 for further details.
5.2 The UV Flood system primarily emits ultraviolet radiation in the UVA range. The recommended threshold limit value for continuous exposure to UVA radiation in the workplace is 1 mW/cm². I-line and g-line measurements of ambient light emitted by the system has been measured to be less than this. To put this number in perspective, UVA exposure on a cloudless summer day regularly exceeds 3 mW/cm².

5.3 Never operate the system with any of the protective covers removed.

6.0 Process Data

6.1 See Appendix 11.1 for information on light uniformity.

7.0 Available Processes, Gases, Process Notes

7.1 N/A

8.0 Equipment Operation

8.1 Performing an Automated Timed Exposure

8.1.1 Turn on the power supply (stand-alone unit located behind the rest of the system). The power switch is located on the left-hand side of the front panel of the supply.

*Allow five minutes for the UV lamp to stabilize and reach its maximum output intensity.*

8.1.2 Remove the metal pallet located inside the UV light shield (the bottom-most portion of the system, see Figure 1) and wipe with acetone to assure cleanliness.

8.1.3 Set the shutter to Automated Timed mode using the switch near the timer on the shutter.

8.1.4 Set cure time in seconds using the timer on the shutter.

8.1.5 Place the sample to be exposed onto the metal pallet and then place the loaded pallet back into the UV light shield.

8.1.6 Once ready to exposure, press the actuate button on the shutter or foot pedal located on the floor beneath the system. The shutter will automatically open for the designated amount of time and then close.

8.1.7 Remove sample loaded pallet.

8.1.8 When you are done curing all samples, turn off the power supply. DO NOT turn off the power supply in between samples as the bulb loses approximately one hour of lifetime each time the lamp power is cycled.

8.1.9 Wipe the pallet with acetone to assure cleanliness and place back inside the UV light shield.

8.2 Performing a Manual Timed Exposure

8.2.1 Turn on the power supply (stand-alone unit located behind the rest of the system). The power switch is located on the left-hand side of the front panel of the supply.

*Allow five minutes for the UV lamp to stabilize and reach its maximum output intensity.*

8.2.2 Set the shutter to manual mode using the switch located next to the timer on the shutter.

8.2.3 Place the sample to be exposed onto the metal pallet (located in the system) and then place the loaded pallet into the UV light shield (bottom-most portion of the system).

8.2.4 Press and hold either the foot pedal or the “Actuate” button on the shutter. The shutter will close as soon as the pedal or button is released.

8.2.5 Remove sample loaded pallet.

8.2.6 When you are done curing all samples, turn off the power supply. DO NOT turn off the power supply in between samples as the bulb loses approximately one hour of lifetime each time the lamp power is cycled.

8.2.7 Wipe the pallet with acetone to assure cleanliness and place back inside the UV light shield.

9.0 Troubleshooting Guidelines
9.1 General Troubleshooting

9.1.1 Power supply does not turn on: Double check that the tool has been enabled on Mercury.

9.2 Common Questions and Answers

9.2.1 How do I calculate an exposure time?

Begin by referring to the vendor data and/or application materials. Typically a dose to clear value will be reported. The equation that relates exposure dose to time and bulb intensity is:

\[ \text{Dose [mJ/cm}^2\text{]} = \text{Intensity [mW/cm}^2\text{]} \times \text{Time [sec.]} \]

The average i-line intensity of the system measured on 11/13/2015 was ~ 10 mW/cm\(^2\). A more up-to-date value can be determined by making a measurement just prior to exposure with the g- or i-line probe located next to the kaligner. Once the dose and intensity are known, use the equation above to solve for time. For example, if the data sheet of a g-line resist calls for 200 mJ/cm\(^2\), and the measured g-line intensity is 10 mW/cm\(^2\), the exposure time is 200 / 10 = 20 seconds.

10.0 Figures & Schematics
11.0 Appendices

11.1 Intensity of i-Line and g-Line vs. Mercury Lamp Warm-Up Time

Table 1: i-Line Intensity Measurements. 'Time Elapsed' indicated how long the mercury bulb had been running before measurements were taken. Measurements were taken in nine places in a grid pattern with each measurement approximately 3'' from its nearest neighbor.
Table 2: g-Line Intensity Measurements. ‘Time Elapsed’ indicated how long the mercury bulb had been running before measurements were taken. Measurements were taken in nine places in a grid pattern with each measurement approximately 3” from its nearest neighbor.

<table>
<thead>
<tr>
<th>Time Elapsed (minutes)</th>
<th>Center Intensity (mW/cm²)</th>
<th>Average Intensity (mW/cm²)</th>
<th>Uniformity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>14</td>
<td>10.6</td>
<td>0.64</td>
</tr>
<tr>
<td>10</td>
<td>11.2</td>
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<tr>
<td>20</td>
<td>11.2</td>
<td>9.3</td>
<td>0.45</td>
</tr>
<tr>
<td>30</td>
<td>11.3</td>
<td>9.2</td>
<td>0.44</td>
</tr>
</tbody>
</table>
Oral Qualification Checklist

- Never operate the system with any of the protective covers removed.
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- Any material that is flammable, must be reviewed by Nanolab Staff prior to use in the system.