UNIVERSITY OF CALIFORNIA, MERCED
SCIF CLEANROOM FACILITY
STANDARD OPERATING PROCEDURE (SOP)
UV Exposure System Operation (350W Collimated NUV Exposure System or Equivalent)
Location: SE1: 154, Class 100 Cleanroom

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1. PURPOSE

To provide a standardized and safe procedure for ultraviolet (UV) exposure processes used in photolithography, ensuring uniform exposure, reproducibility, and user safety.

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2. SCOPE

Applicable to all trained users performing UV exposure for photoresist patterning, flood exposure, resist stabilization, and related lithography processes.

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3. RESPONSIBILITIES

- **Users:** Follow SOP and exposure parameters
- **Core Staff:** Maintain system and provide training
- **Facility:** Ensure safe operation and compliance

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4. SYSTEM OVERVIEW

The UV exposure system uses a high-intensity mercury arc lamp and optical system to generate a uniform, collimated UV beam for photolithography.

Capabilities:
- Photoresist exposure (350–450 nm NUV range)
- Uniform flood exposure
- Edge bead exposure
- High uniformity (±5–6%)

👉 The system uses dielectric mirrors and an optical integrator to produce a uniform beam

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5. REQUIRED SYSTEM CONDITIONS

5.1 Utilities

- AC Power supply
- UV lamp power supply operational
- Cooling/exhaust system active
- Shutter control system functional

5.2 System Conditions

- Lamp properly installed
- Optical components clean
- Shutter functional
- System covers in place
- Proper ventilation available

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6. SAFETY REQUIREMENTS

6.1 Hazards

- Intense UV radiation (eye/skin damage)
- Lamp explosion risk
- Ozone generation
- Electrical shock (high voltage)
- Mercury exposure (lamp)

6.2 PPE

- UV-blocking safety glasses
- Cleanroom gloves
- Lab coat
- Face shield (during lamp handling)

6.3 Critical Safety Rules

• NEVER look directly at UV beam
• ALWAYS wear UV eye protection
• Do NOT operate without covers in place
• Ensure proper ventilation (ozone removal)
• Disconnect power before maintenance

👉 UV radiation and lamp explosion are major hazards requiring strict precautions

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7. CLEANROOM PROTOCOL

• Handle wafers using tweezers
• Ensure photoresist-coated samples are clean
• Avoid contamination on exposure stage
• Keep optics and stage particle-free

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8. DETAILED OPERATION PROCEDURE

STEP 1: SYSTEM PRE-CHECK

• Verify:
o Power supply ON
o Cooling/exhaust active
o Lamp installed correctly
o Covers secured

STEP 2: WARM-UP

• Turn ON UV lamp
• Allow warm-up (10–15 minutes)

👉 Lamp must reach stable operating conditions for uniform exposure

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STEP 3: SET EXPOSURE PARAMETERS

• Set lamp power (typically 280–380 W for 350W system)
• Set exposure time
• Confirm intensity settings

STEP 4: LOAD SAMPLE

• Place wafer/sample on exposure stage
• Align sample properly
• Ensure flat contact

STEP 5: ALIGN AND VERIFY INTENSITY

• Place UV meter (if required)
• Verify uniform intensity
• Adjust lamp Z-position for peak intensity

👉 “Peaking” the lamp maximizes exposure intensity

STEP 6: PERFORM EXPOSURE

• Close system cover
• Activate shutter
• Expose for defined time

STEP 7: COMPLETE EXPOSURE

• Close shutter
• Remove sample
• Proceed to development process

STEP 8: SHUTDOWN

• Turn OFF lamp (if not in continuous use)
• Allow system to cool
• Turn OFF power supply if required

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9. TROUBLESHOOTING GUIDE

Issue	Cause	Action
Low intensity	Lamp aging	Replace lamp
Non-uniform exposure	Misalignment	Re-align lamp
Overheating	Poor cooling	Check exhaust
Ozone smell	Ventilation issue	Increase airflow
No exposure	Shutter failure	Check control system

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10. CRITICAL DOs & DON'Ts

DO

- Allow proper lamp warm-up
- Use UV protection
- Maintain clean optics
- Monitor intensity regularly

DON'T

- Look into UV beam
- Operate without covers
- Touch lamp quartz surface
- Adjust optics unnecessarily

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11. CONTAMINATION CONTROL

- Keep optics clean (lens, mirrors)
- Avoid touching optical surfaces
- Clean with IPA and lint-free wipes
- Maintain clean exposure stage

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12. WASTE HANDLING

• Dispose lamps as hazardous waste (mercury-containing)
• Follow SCIF hazardous waste procedures

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13. EMERGENCY PROCEDURES

• Lamp explosion → Evacuate area, allow cooling
• UV exposure → Seek medical attention
• Electrical issue → Power OFF immediately
• Ozone buildup → Ventilate area

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14. TRAINING COVERAGE

Users are trained on:
• UV lithography principles
• Exposure dose control
• Lamp handling and safety
• System calibration and intensity measurement
• Emergency procedures

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15. ACKNOWLEDGMENT & APPROVAL

Director Name: _____

Director Signature: _____

Date: _____

User Name: _____

User Signature: _____

Date: _____