

# User Fees for the 4D LABS Fabrication Facility

## 1. Clean Room Fees

| Service   | Academic Rate |
|---|---------------|
| Clean Room access:  |               |
| <ul style="list-style-type: none"> <li>Includes use of all Clean Room tools except for those in the groups listed below</li> </ul>  | \$35/hr       |
| Group I tools:  |               |
| <ul style="list-style-type: none"> <li>Plasma reactors</li> <li>Mask aligner 2 (Kasper)</li> <li>Probe station</li> </ul>   | \$10/hr       |
| Group II tools:   |               |
| <ul style="list-style-type: none"> <li>Mask aligner 1 (OAI)</li> <li>Nanoimprint lithography</li> <li>Physical vapor deposition 1, 2, 3, and 4</li> <li>RIE 2 (fluorine-based system)</li> <li>Rapid thermal annealer 1 and 2</li> <li>Critical point dryer</li> <li>XeF<sub>2</sub> etcher</li> <li>Atomic layer deposition</li> </ul> | \$20/hr       |
| Group III tools:  |               |
| <ul style="list-style-type: none"> <li>RIE 1 (chlorine-based system)</li> <li>Direct write laser lithography</li> <li>Thermal SiO<sub>2</sub> growth and P-diffusion</li> <li>Robotic lithography tool</li> </ul>   | \$30/hr       |
| Group IV tools:   |               |
| <ul style="list-style-type: none"> <li>Electron beam lithography</li> <li>LPCVD (Si<sub>3</sub>N<sub>4</sub>, polysilicon)</li> <li>PECVD (SiO<sub>2</sub>, Si<sub>3</sub>N<sub>4</sub>, Si)</li> </ul>   | \$40/hr       |
| Clean Room gown rental (hood, coveralls, boots)   | \$15/day      |
| Training  | \$30/hr       |
| Technical Labor Rate  | \$75/hr       |

## 2. Non-Clean Room Fees

| Service  | Academic Rate   |
|--|---|
| Glove Box (TASC2 6140)   |   |
| <ul style="list-style-type: none"> <li>• Standard usage</li> <li>• Evaporator usage</li> </ul>   | \$15/hr<br>\$45/hr  |
| High Temperature Furnace or Vacuum Oven (TASC2 6070)   | \$2.50/hr   |
| Laser Machining Lab (TASC2 6072):  |   |
| <ul style="list-style-type: none"> <li>• Dicing Saw</li> <li>• Laser Scriber</li> <li>• Laser Micromachining</li> </ul>  | \$30/hr<br>\$30/hr<br>\$40/hr                                 |
| PVD 5 (TASC2 6140)   | \$40/hr   |
| Wet Lab and Polymer Coating Tooling (TASC2 6074 and 6076):   |   |
| <ul style="list-style-type: none"> <li>• Wetbench 6 (Electroplating)</li> <li>• Wetbench 7 (Acid Cleaning)</li> <li>• Wetbench 8 (General Solvent)</li> <li>• Wetbench 9 (Organic Cleaning)</li> <li>• Spray Coater/Screen Printer</li> <li>• Hot Press</li> </ul> | \$40/hr<br>\$20/hr<br>\$20/hr<br>\$20/hr<br>\$20/hr<br>\$5/hr |
| Training   | \$30/hr   |
| Technical Labor Rate   | \$75/hr   |

### 3. Mask Fabrication Fees

| Service   | Academic Rate     |
|---|-------------------|
| <p><b>Mask Writing</b></p> <p>The rate includes developing, etching, and cleaning of photomask. Rates also include costs for packaging.</p> <p>Write times longer than 2 hrs will be charged at a rate of \$60/hr. The minimum charge for using the 4mm and 2mm lens is \$180/mask.</p> <p>The write time is determined primarily by the total area of the design, <i>including</i> white spaces, and the minimum feature size.</p> <p>Our standard photomasks are 4" x 4" or 5" x 5" chrome on soda-lime glass. Other sizes and materials may be available on a custom order basis at an extra cost.</p> | <p>\$120/mask</p> |
| <p><b>Shipping and Handling within Canada (2 business days)</b></p> <p>Rates may vary for shipping multiple masks, priority shipments, or sending outside of Canada</p>   | <p>\$20/mask</p>  |

## 4. Materials and Supplies<sup>†</sup>

| Product   | Cost      |
|---|-----------|
| Clean Room gown set (incl. gown, hood, and boots)           | \$200     |
| Clean Room notebook   | \$15      |
| Safety goggles  | \$20      |
| Tweezers:   |           |
| • ESD-safe carbon-tip wafer tweezers (multiple sizes)       | \$55      |
| • Replacement tip for 2" wafer                              | \$23      |
| • Replacement tip for 4" wafer                              | \$23      |
| • Replacement tip for fine pieces                           | \$21      |
| PVD metal charge:   |           |
| • platinum  | \$0.45/nm |
| • gold  | \$0.65/nm |
| • palladium   | \$0.50/nm |
| • ITO   | \$0.35/nm |
| • others PVD materials                                      | \$0.03/nm |
| ALD metal charge:   |           |
| • platinum  | \$10/nm   |
| • hafnium oxide   | \$2.25/nm |
| • aluminum oxide  | \$1.00/nm |
| • silicon oxide   | \$1.00/nm |
| Electroplating precious metal charge:                       |           |
| • gold  | \$10/Amin |
| Wafers:   |           |
| • 2" silicon wafer (100), prime grade                       | \$20      |
| • 2" silicon wafer (100), prime grade, double-side polished | \$35      |
| • 2" silicon wafer (100), prime grade, 100 nm dry oxide     | \$69      |
| • 2" silicon wafer (100), prime grade, 100 nm dry nitride   | \$75      |
| • 4" silicon wafer (100), prime grade                       | \$28      |
| • 4" silicon wafer (100), reclaimed                         | \$10      |
| • 4" silicon wafer (100), prime grade, 100 nm dry oxide     | \$77      |
| • 4" silicon wafer (100), prime grade, 100 nm nitride       | \$83      |
| • 4" glass wafer, soda-lime, double-side-polished           | \$45      |
| • 6" silicon wafer (100), prime grade                       | \$38      |

Wafer Carriers:

- 2" carrier for individual wafers \$6
- 2" carrier for 25 wafers \$15
- 4" carrier for individual wafers \$8
- 4" carrier for 25 wafers \$30
- 6" carrier for individual wafers \$13

Gel-Pak for wafer pieces \$8

Bare Glass Plates:

- 4" soda-lime glass \$15
- 5" soda-lime glass \$20

Mask Carriers:

- 4" mask carrier \$15
- 5" mask carrier \$10

Nanoimprinter sealing film set \$200

Steel shim for shadow masks \$30

Spray coater syringe \$325

<sup>†</sup> Note: The prices listed in this table are valid as of December 2018. The prices may vary according to the market price.

## 5. Academic Breakpoints for Service Fees in the Fabrication Facility

| Cumulative Monthly Usage <sup>†</sup> | Discount         |
|---------------------------------------|------------------|
| \$0 → \$500                           | 0% <sup>††</sup> |
| \$500 → \$1250                        | 50%              |
| > \$1250                              | 75%              |

<sup>†</sup> The cumulative usage is for a single Principal Investigator regardless of the number of users in the group.

<sup>††</sup> There is funding available for Canadian academic users from CMC Microsystems for up to \$2000 at an 80% discount rate. See the following link for more details:

<http://www.cmc.ca/WhatWeOffer/Make/MNTPortal/FinancialHelp.aspx>

\* Discounts are not applied toward materials purchases (*e.g.*, metals, tweezers, gowns, etc.), photomask orders, or contract work.

### *Rules and Regulations:*

1. Users of the Fabrication and Prototyping Facility must be qualified on each tool used. This must be done through technician training at rates listed above. Training times will vary based on the complexity of the tool and the experience of the user.
2. Minimum usage is one half hour for all equipment.
3. External academic users who wish to have a 4D LABS technician run a sample for them (e.g., sample preparation, data acquisition, and data processing) will have to make these arrangements through 4D LABS ([nanofabrication@4dlabs.ca](mailto:nanofabrication@4dlabs.ca)). Cost estimates can be compiled based on a 10, 5, or 1 day turnaround time.
4. Invoices are normally sent on a monthly basis and payments can be made by cheque or account transfer (internal users only).
5. Payments are due Net (30) days from invoice date. Past due invoices are subject to a service charge of 1.5% per month (18% annual) on the unpaid balance or the maximum legal rate permitted by provincial law, whichever is lower.

### *Special Notes:*

1. The Clean Room access fee includes access to standard clean room resists, developers, solvents, and acids. It also includes access to a gown cleaning service.
2. There are separate fees for Clean Room access and for usage of each machine in the Clean Room.
3. Academic Principal Investigators will be charged a flat rate of \$35.00 per instance of admittance into the Clean Room to observe the progress of their students.
4. All normal operation of PVD 1, 3, 4, and 5, such as venting, pumping, and deposition, is billable time. Due to the long pump down time on PVD 2, users are permitted to load their samples without charge, and log their time-in at the start of deposition. Time-out is at end of system use.
5. All PVD depositions need to be recorded using the correct material or "Other PVD Materials".
6. Please contact us for billing on extended ALD runs.
7. For the high-temperature furnace in TASC2 6070, the time charged will include ramp-up time, bake time, and up to 1 hour of cool-down time.
8. For ellipsometer modeling, EBL pattern design, and photomask design, please use the computer station located in TASC 2 room 6140. There is no cost to users for access to this station.
9. The XPS usage fee includes access to data analysis software.
10. The XRD usage fee includes access to a sample preparation station, data analysis software, and crystal structure databases.
11. Lockers are available outside the Clean Room for a nominal charge of \$1/day.