Minimum Feature Size

When submitting a Mask Fabrication Request form, we ask what the minimum feature size on your design is. The width of the narrowest polygons or the size of the smallest polygons would typically represent the minimum feature size if you were requesting a dark field photomask (where the polygons are written and become clear window and the background remains chromium coated). The smallest gap or spacing between polygons will typically represent the minimum feature size if you were requesting a bright field photomask (where the background is written). The minimum feature size you specify in your request will prompt us to select an appropriate objective lens for the writing process. The table below lists our options (for your information only).

<table>
<thead>
<tr>
<th>Objective Lens</th>
<th>Laser Spot</th>
<th>Writing time of a 5 inch photomask</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mm</td>
<td>5 µm</td>
<td>2-3 hours</td>
</tr>
<tr>
<td>10 mm</td>
<td>2.5 µm</td>
<td>12-18 hours</td>
</tr>
<tr>
<td>4 mm</td>
<td>1 µm</td>
<td>36-48 hours</td>
</tr>
</tbody>
</table>

Resolution

The ultimate resolution of our photomask making process is close to 1 µm if all parameters are carefully optimized. For the sake of throughput, however, we ask that you do not submit requests with smaller than 2 µm minimum feature sizes, unless we agreed to work with you separately, outside of the fabrication queue.

Above: SEM image of a completed photomask showing bright field patterns. The array of rectangles has equal width and gap as marked by the number in microns. So, for example, the smallest array has one micron wide rectangles and one micron wide gap (resulting in a 2 µm pitch). Fabricated on July 25, 2022.
**Accuracy**

The accuracy of fabricating patterns in the exact dimensions of your submitted CAD drawing is primarily limited by the lack of optical proximity correction in our process. If you need to have exact dimensions in parts of your photomask, please talk to us about the feasibility. You may consider ordering your photomask from a professional shop dedicated to photomask making.

Above: Optical micrograph of a completed photomask in backside illumination showing dark field and bright field exposures of the same CAD design.

Below: SEM images reveal in close-up views of the 2 µm wide rectangles in 4 µm pitch that in case of bright field exposure the gaps between chromium stripes are nearly 500 nm larger than in the dark field pattern. Because all exposure parameters are the same, the difference is originating from the background exposure of the bright field.

In addition to variations originating from the lack of proximity correction, the highest resolution patterns may also be affected by periodic modulations originating from our laser writer and that are related to noise during our writing process.
Uniformity and repeatability

When it comes to uniformity across a high-resolution photomask fabricated by us, our limitations are mainly related to environmental control during the 2 day long writing process.

When a photomask set is requested with expected high alignment accuracy between photomasks in the set, please make a comment in the Mask Fabrication Request from. We will need to carefully monitor temperature oscillations in the Bay.