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Photomask Defects Report

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Critical Factors

- Transparency photomasks have inherent defects that are transferred onto the master
- Defects will be more pronounced for thin features (5-10um) with low dose
- Consider chrome masks if needed to minimize defects

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1. Transparency Photomask

SEM Imaged microfluidics wafer (KMPR-1025) in regions corresponding to previous images of photomask defects

- Observed large dark defects under white-light corresponding to defects in the photomask used to generate the master
- Under SEM imaging at high magnification, these defects in the KMPR master were actually found to be relatively unobtrusive, shallow depressions in the resist layer
- The defects of the photomask result in a “pocking” of the entire resist surface when viewed at high magnification
- When a mask defect resides at the edge of a resist feature, the defect can be seen to “widen” as one proceeds through the thickness of the resist from the top (free standing surface) to the bottom (Si surface)
Figure 1: Images of photomasks and KMPR masters
Figure 2: Region of Interest 1

Figure 3: Region of Interest 2
Figure 4: Region of Interest 3

Figure 5: Region of Interest 4
Figure 6: Region of Interest 5

Figure 7: Region of Interest 6
2. Chrome Mask

Figure 8: Image of chrome mask master sidewall

Figure 9: Magnified region of interest from Figure 8
3. Dose Effect on Resist

- All features are KMPR1005, 10um wide and 5um high
- Low dose results in more pronounce effect of photomask defects compared with chrome masks

![Photomask transparency, nominal dose](image1)

Figure 10: Photomask transparency, nominal dose

![Chrome mask, nominal dose](image2)

Figure 11: Chrome mask, nominal dose
Figure 12: Photomask transparency, 25% above nominal dose

Figure 13: Chrome mask, 25% above nominal dose
Figure 14: Photomask transparency, 50% above nominal dose

Figure 15: Chrome mask, 50% above nominal dose