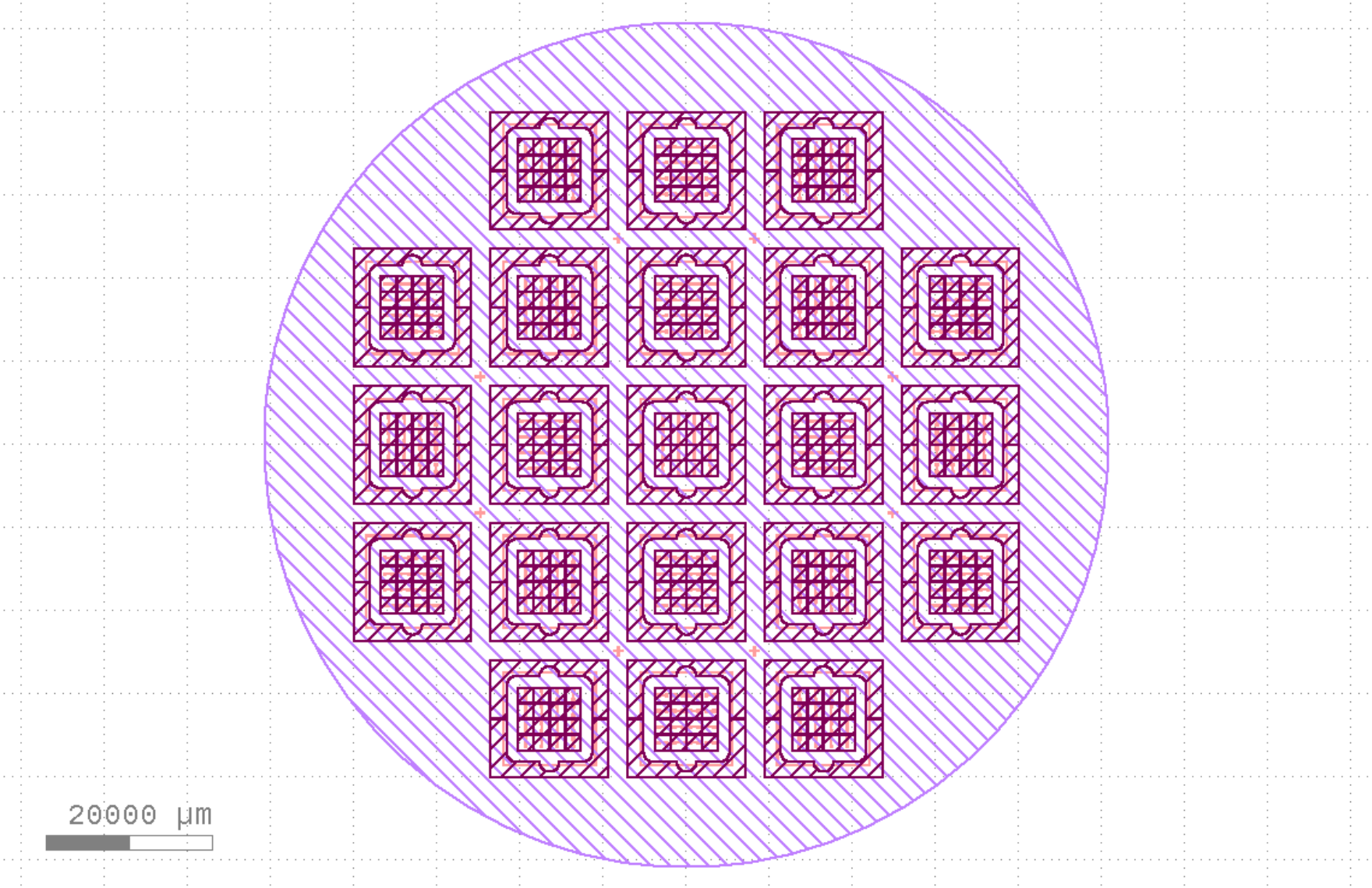
07/08/2023

Growth and Characterization of Superconducting Josephson Junctions in Low-Temperature MBE

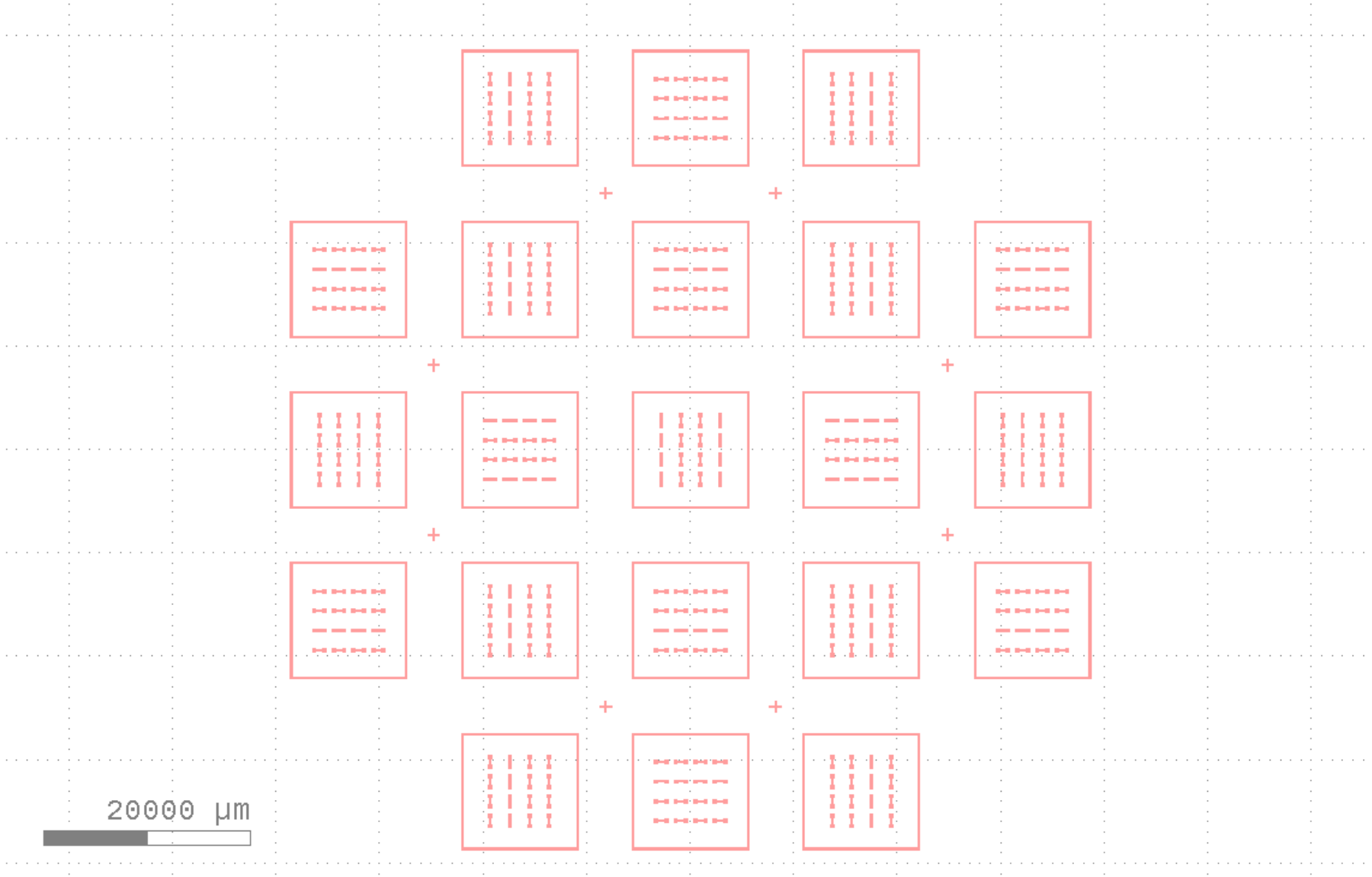
Shirshendu Chatterjee

Design of the Shadow Mask for the Josephson Junctions

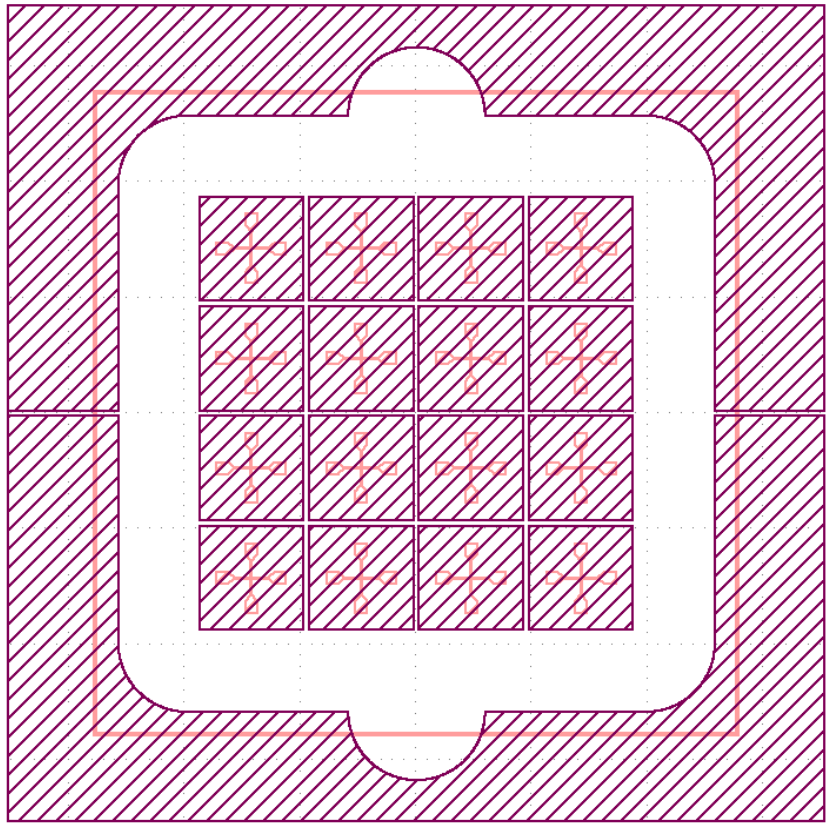
Shadow Mask – Design 1.

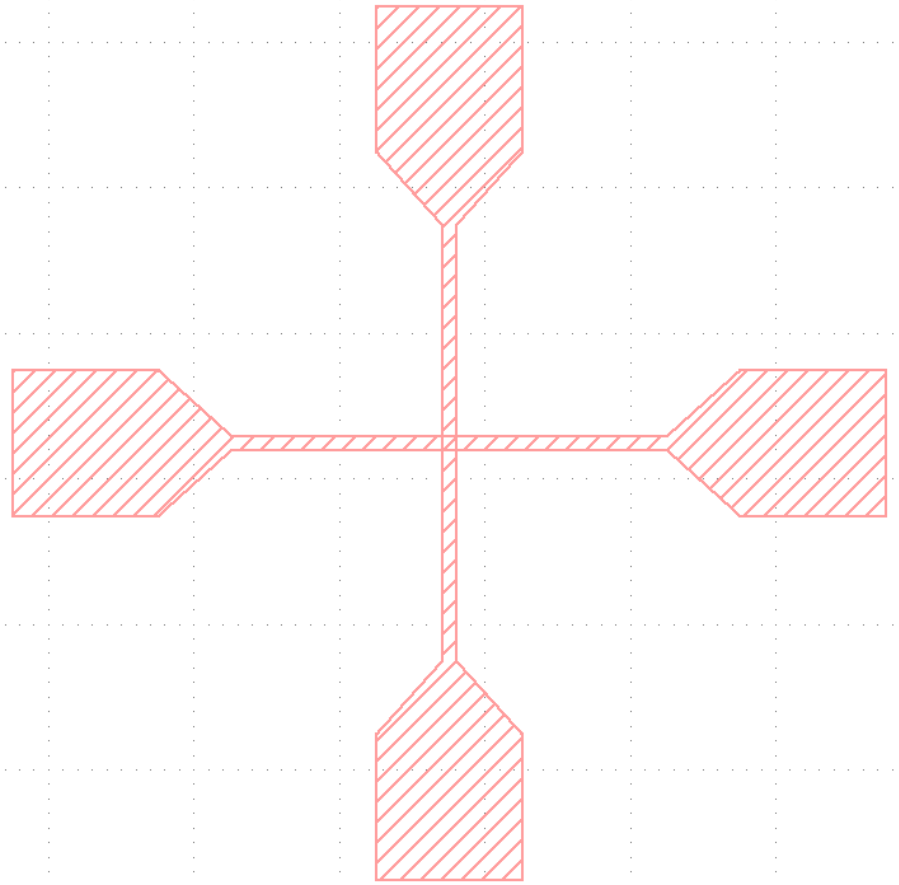


Lithography Design – 1.

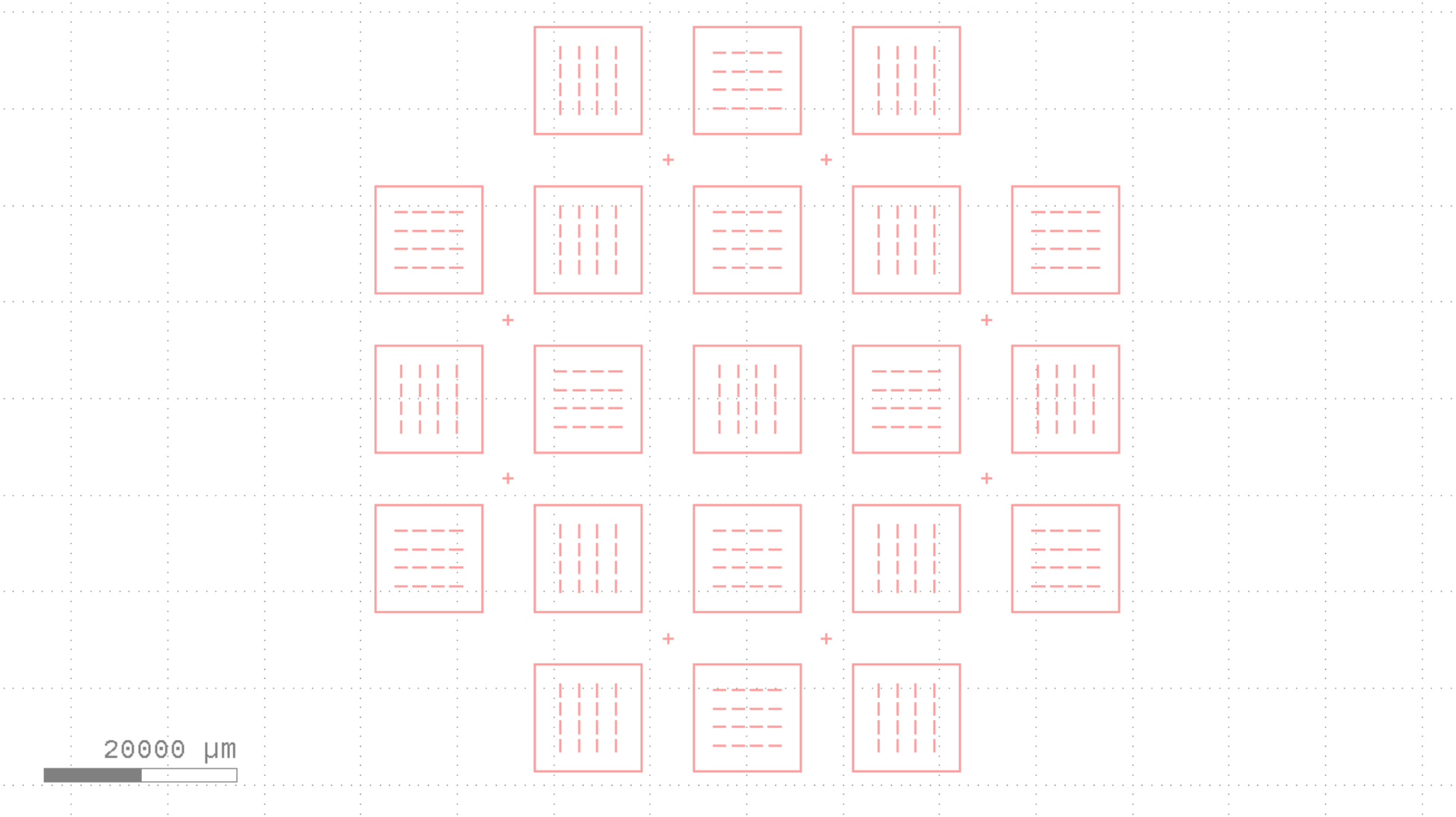


Josephson Junction - 2

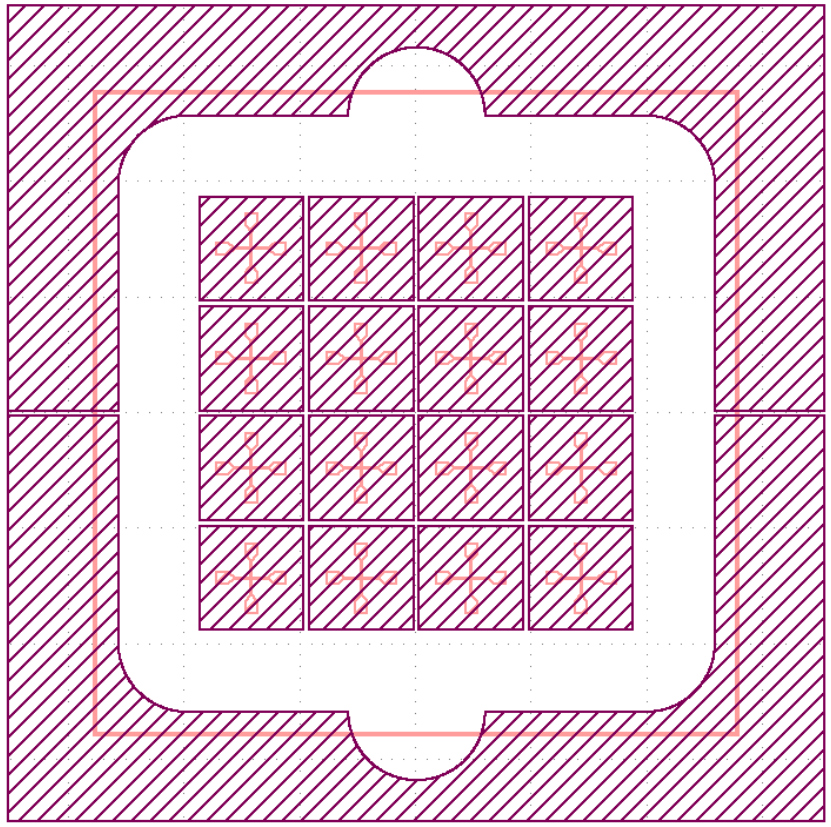


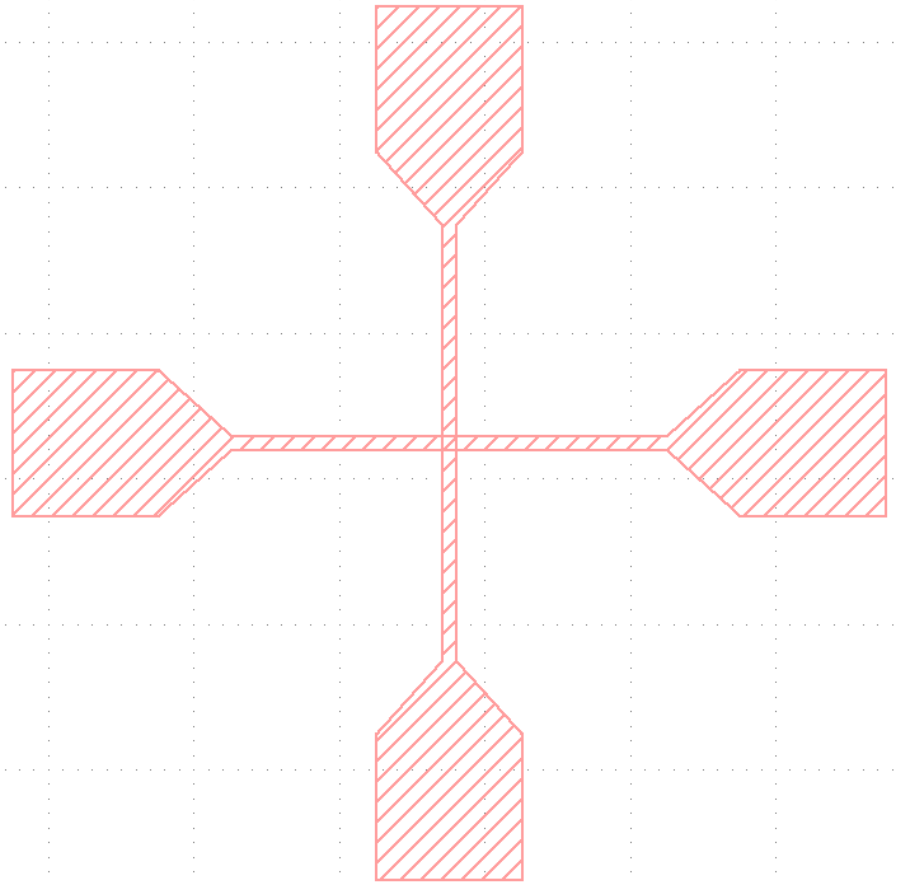


Lithography Design – 2.



Josephson Junction - 2



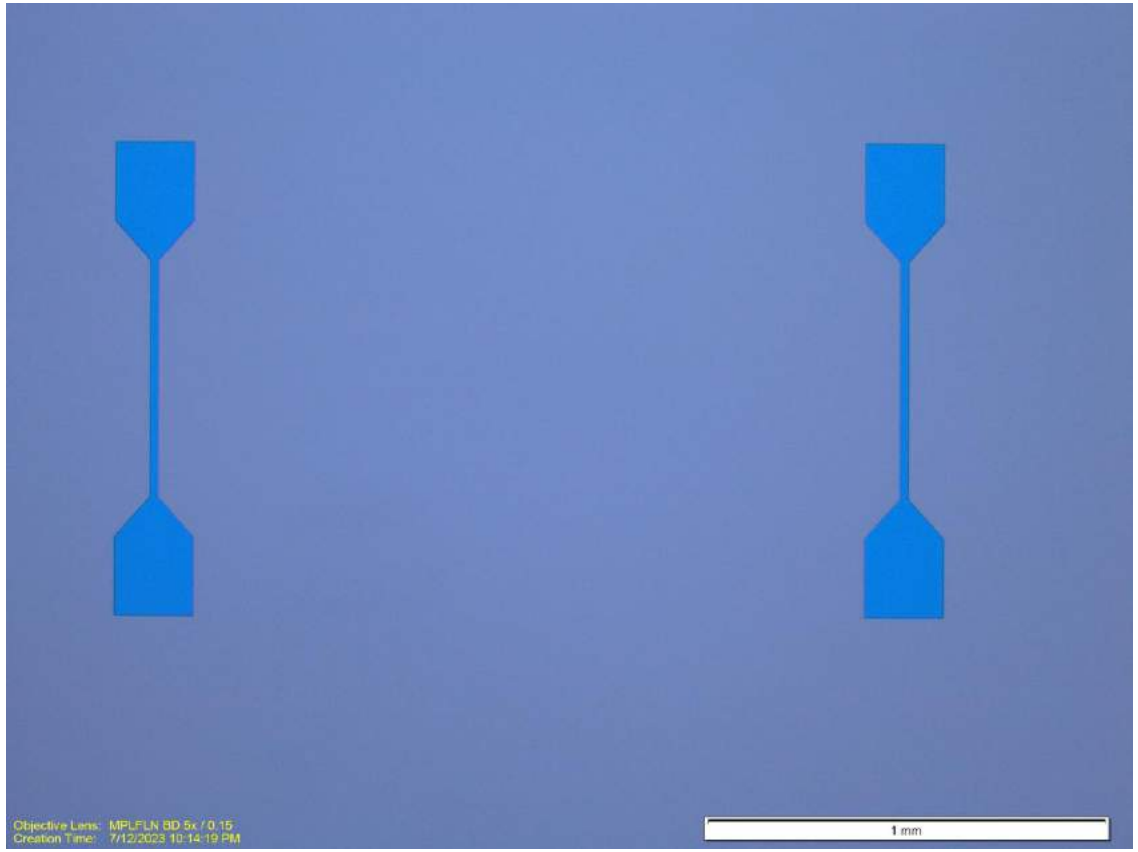


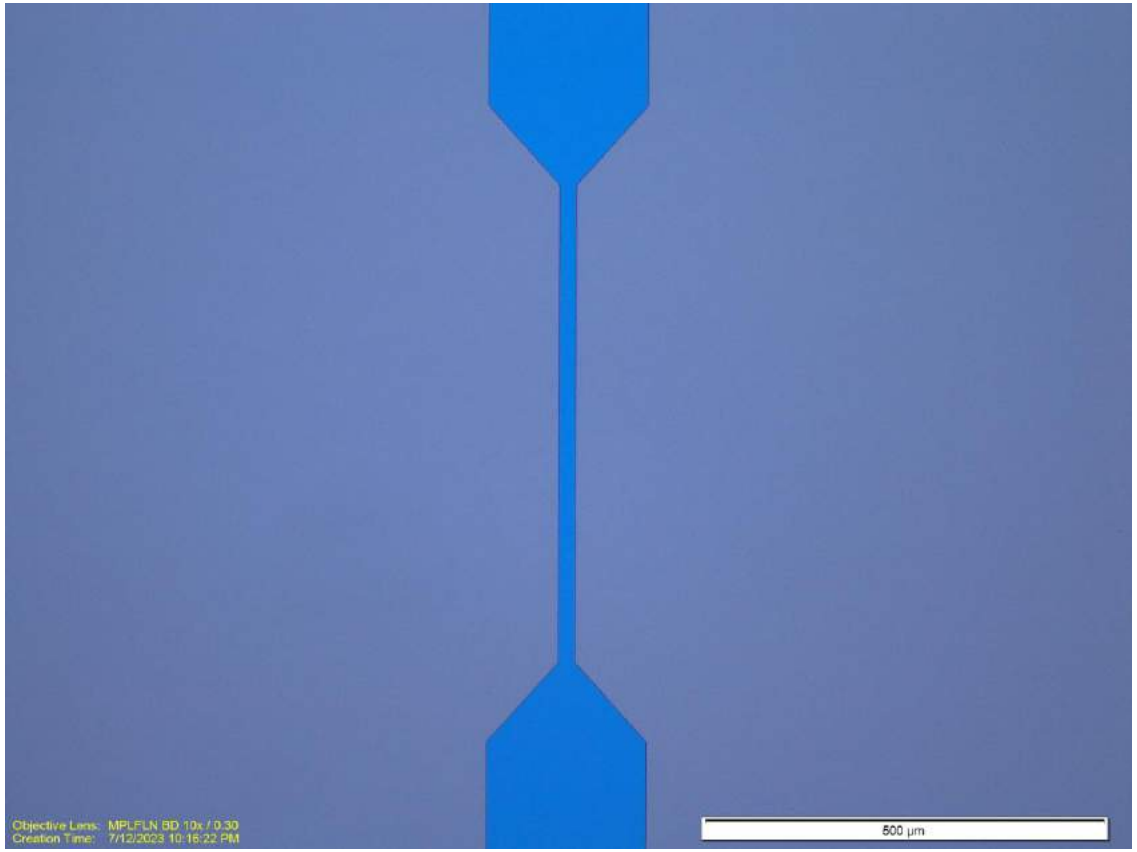
Patterning the Top Layers

Recipe – 1st Lithography

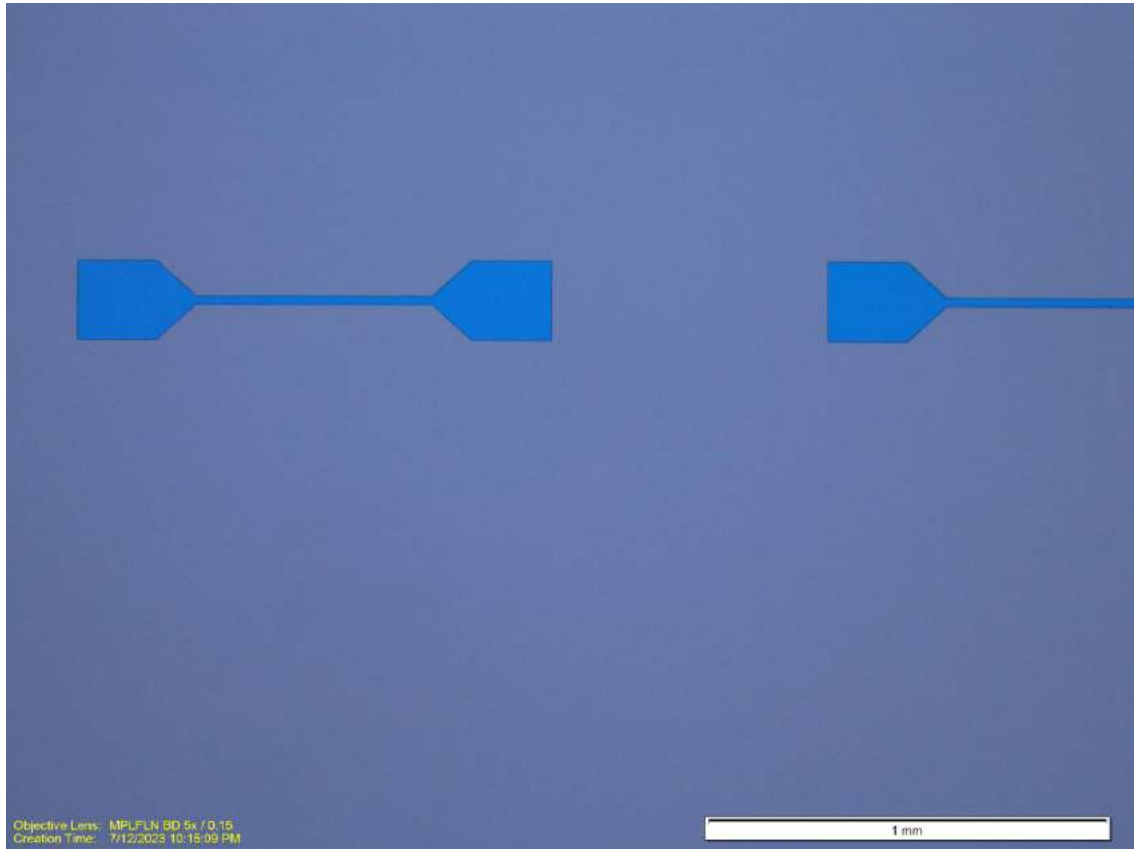
1. 2 min Acetone in USW
2. 2 min Isopropanol in USW
3. PE II at 300mTorr and 100 Watts O_2 for 15 secs.
4. Spin resist AZ4110 at 4krpm for 30s ~ **1.2um thick**
5. Soft bake for 60 sec at 95C
6. MLA: **405nm** Laser, dose **300** mJ/cm2 and defocus **4**
7. AZ400K 1:4 developer for 60 sec
8. DI for 60 sec

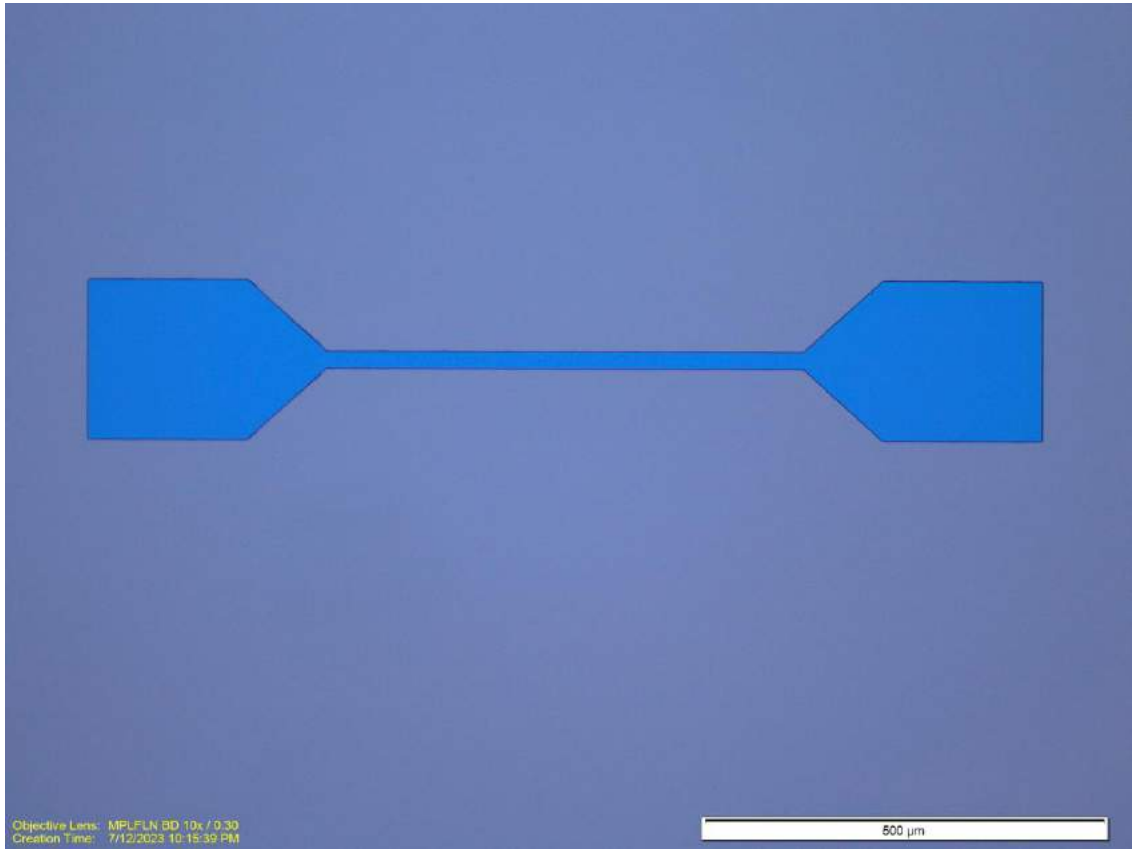
After 1st Lithography





After 1st Lithography

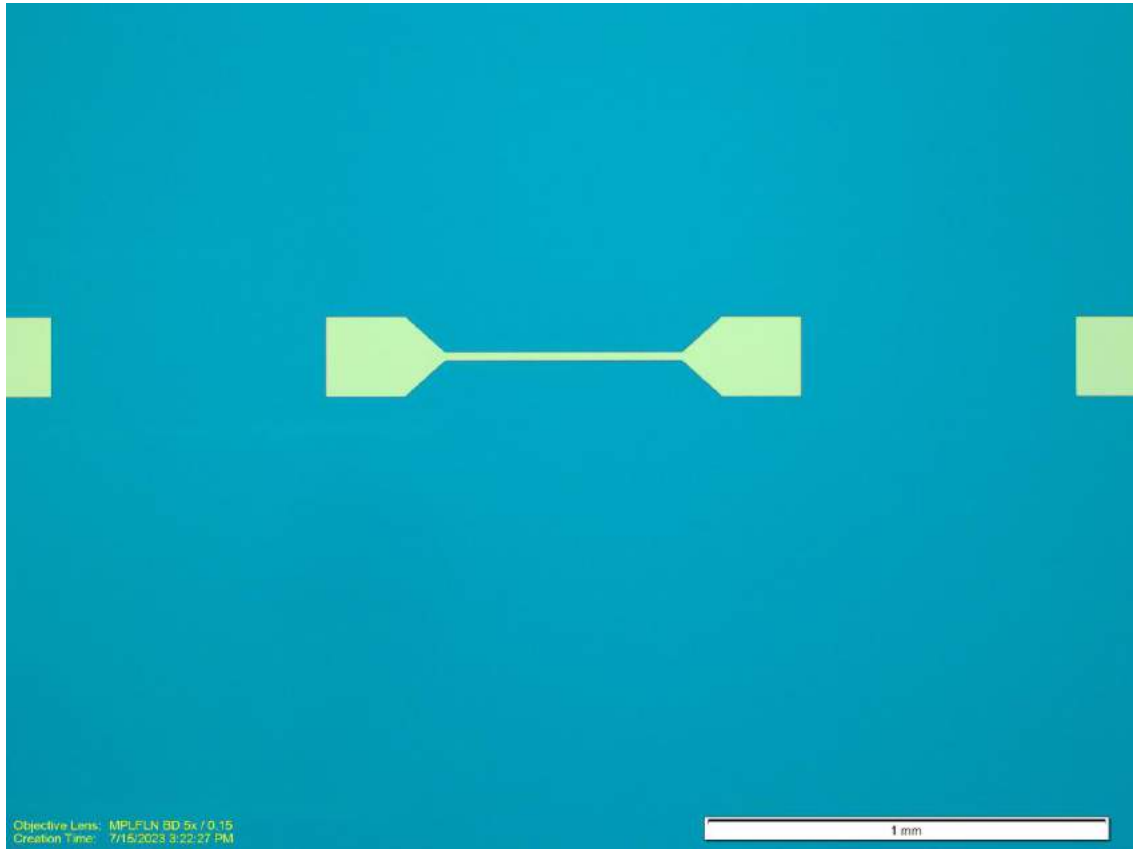


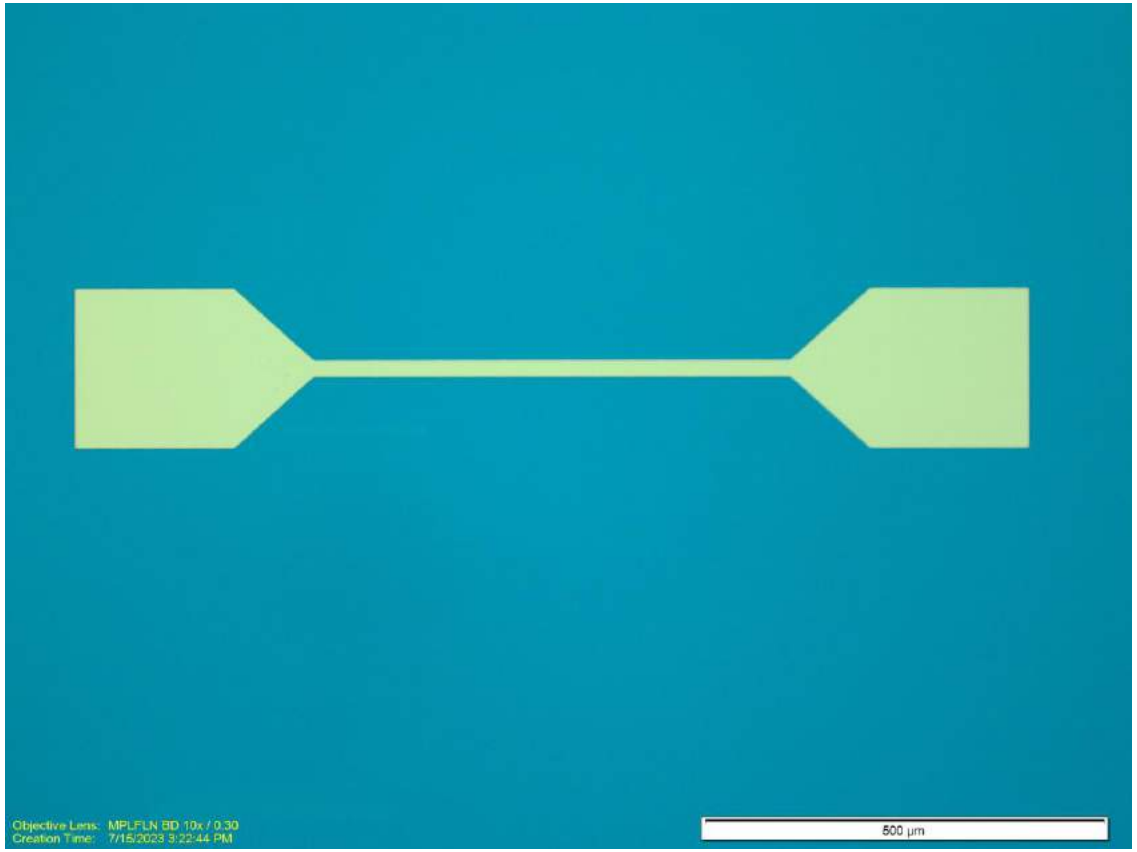


Recipe – Dry Etch and PECVD

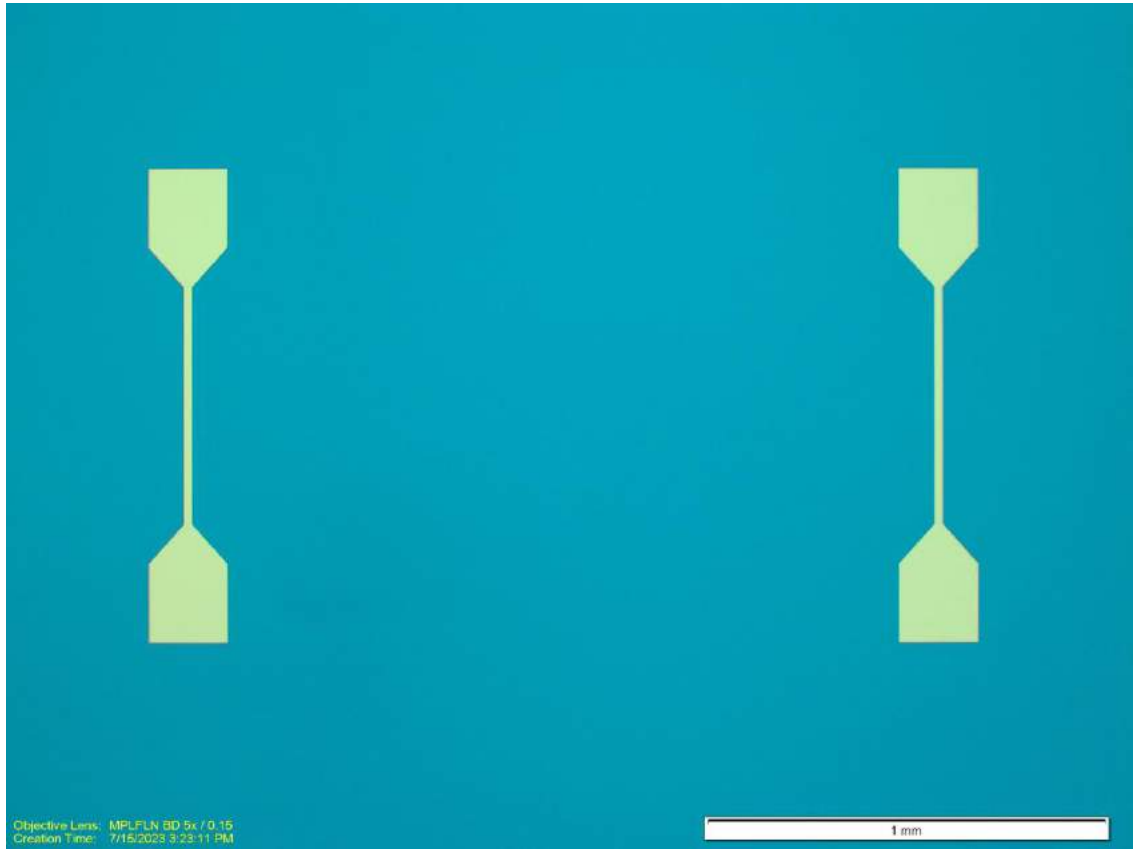
1. PE II 300/100 O2 for 15 sec
2. ICP #1 – O2 clean for 5 min
   CF4/O2 coat for 2 min
   CF4/O2 etch for 4 min
   O2 clean for 5 min

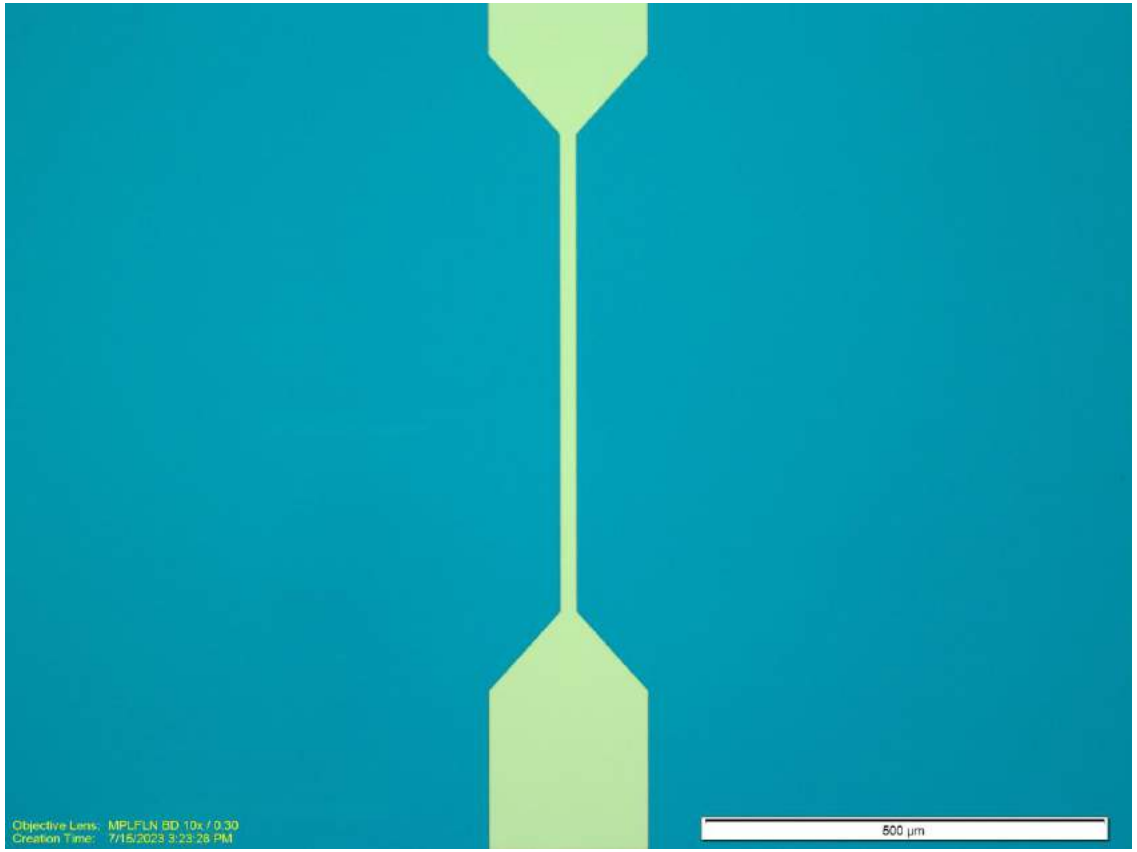
After Dry Etch



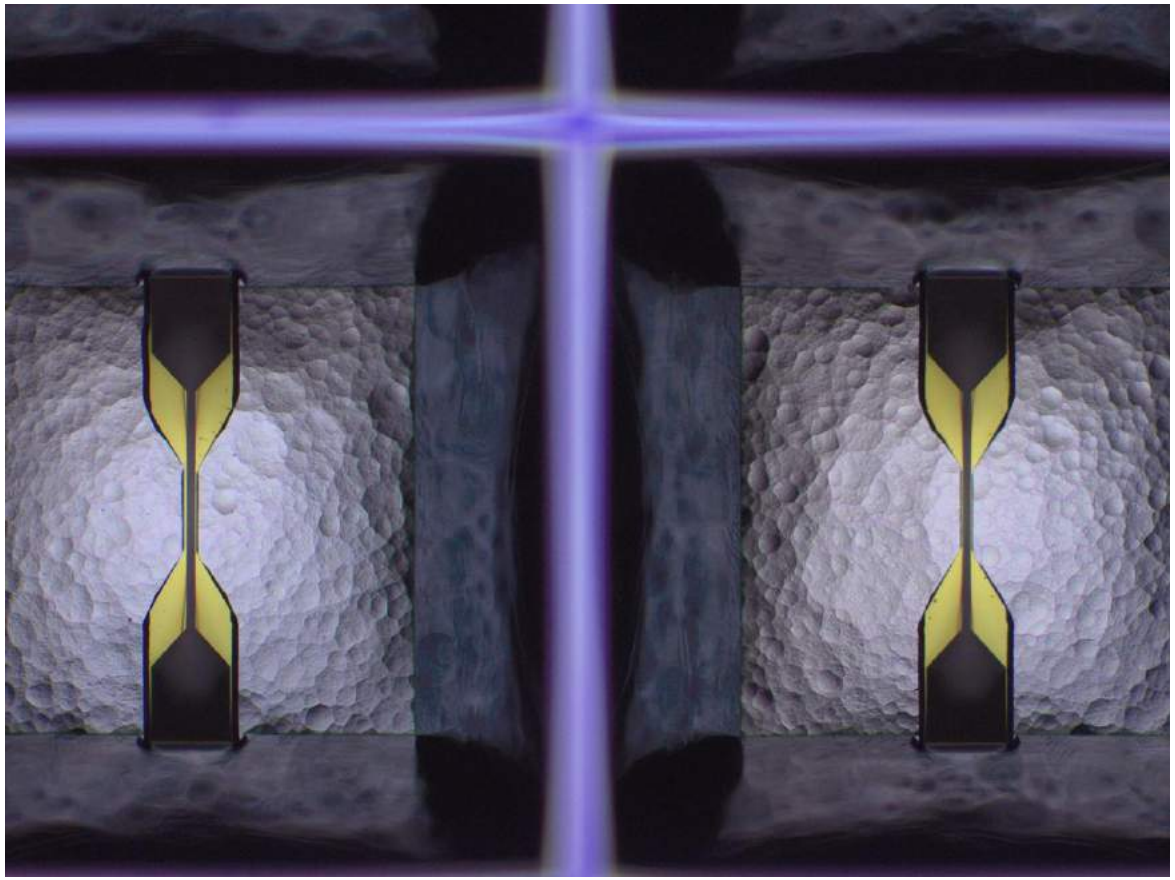


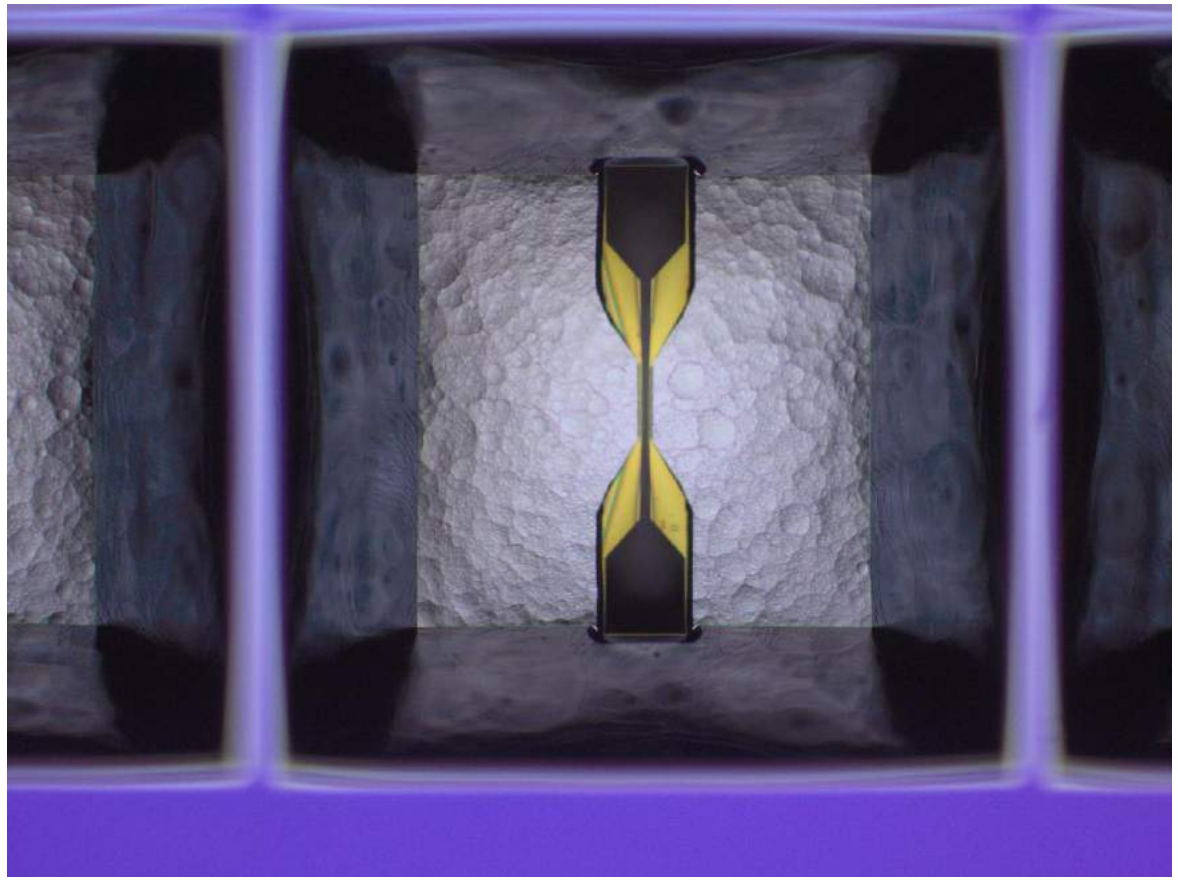
After Dry Etch



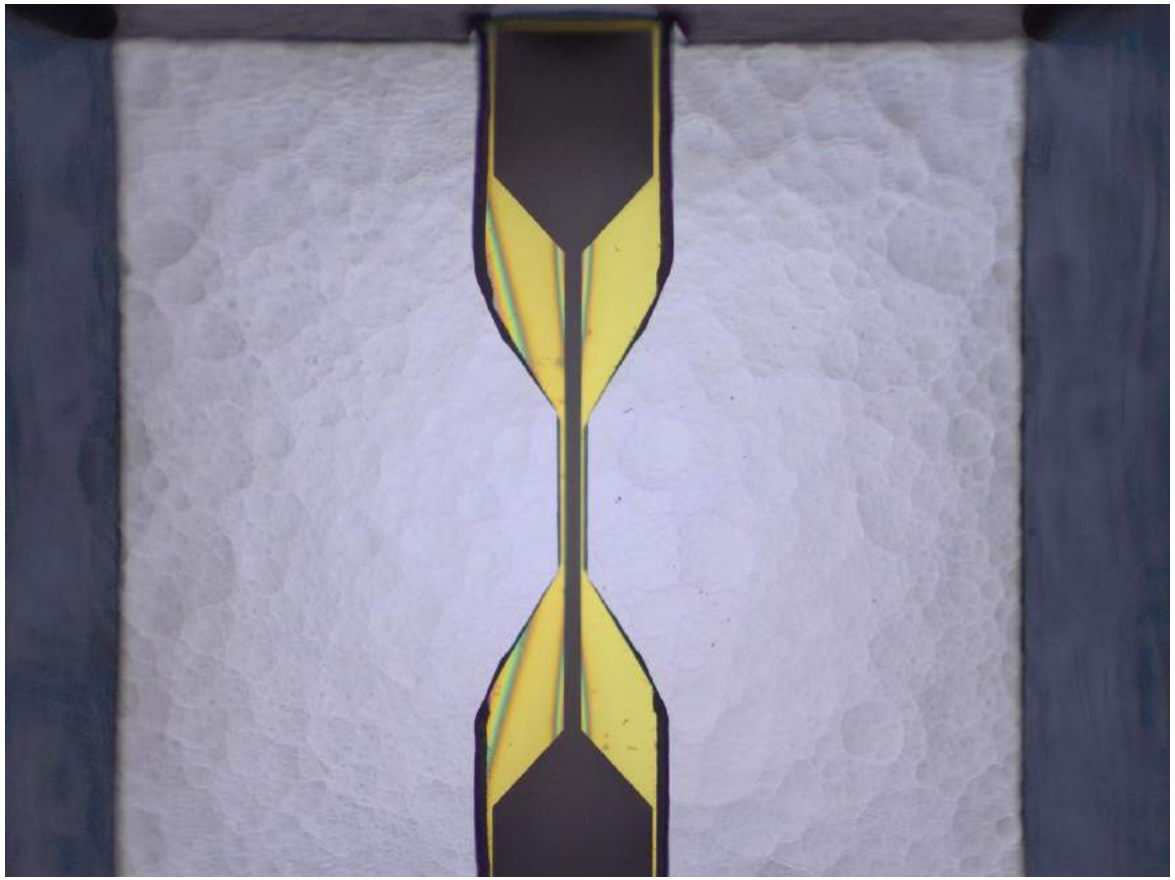


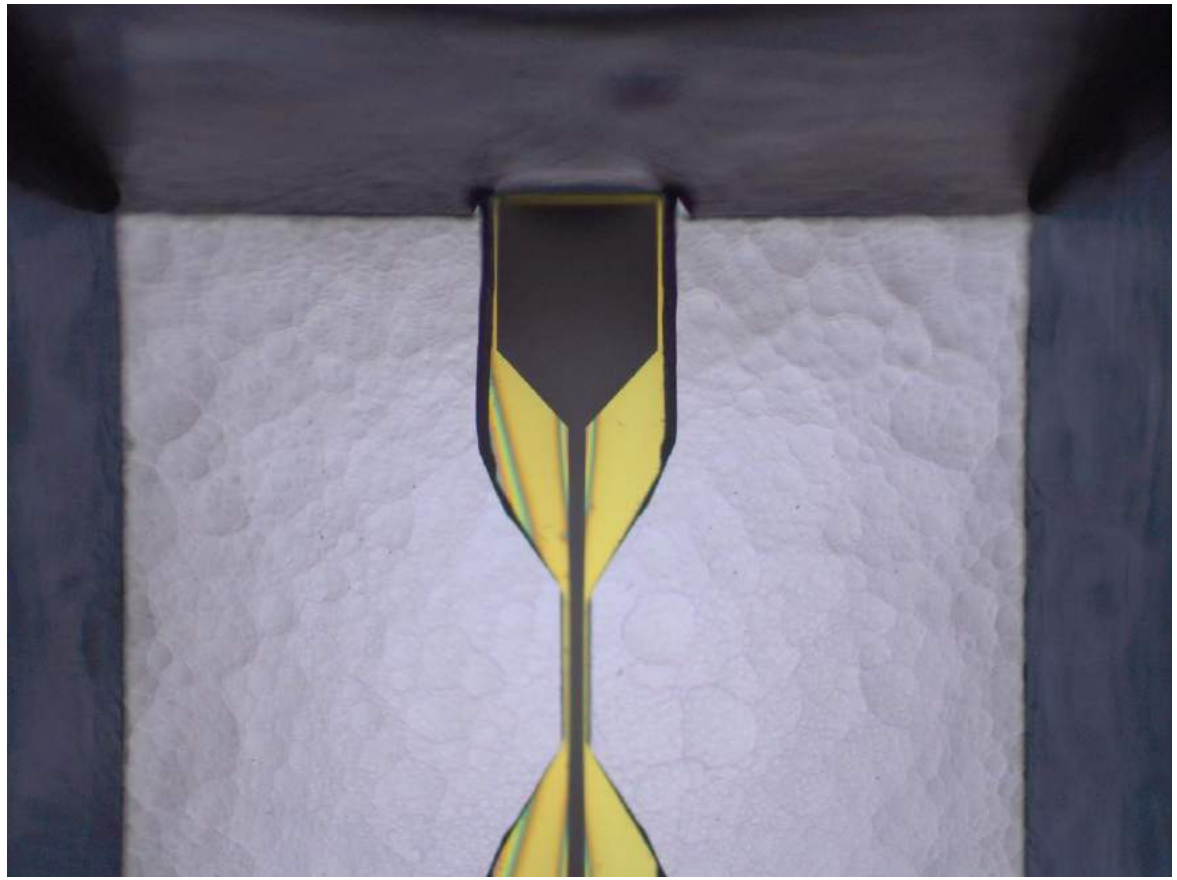
After Final KOH etch



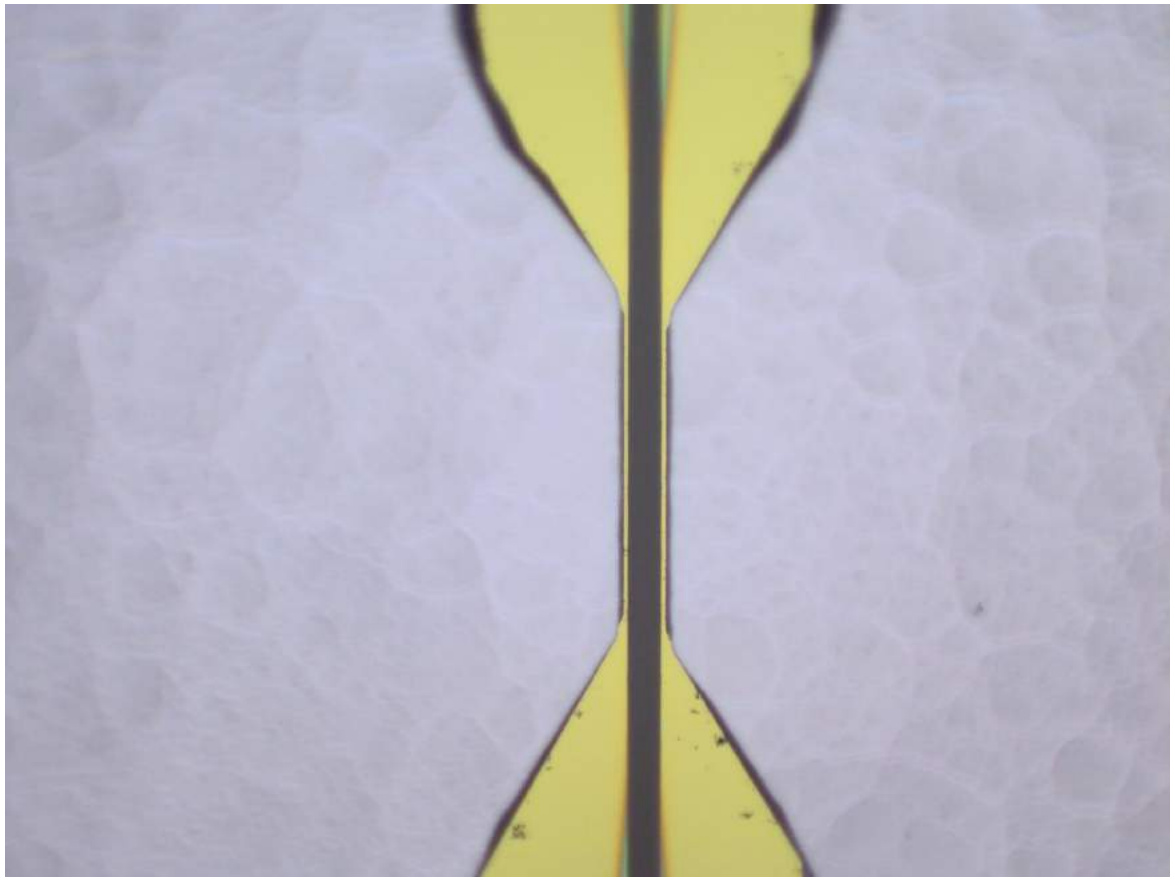


After Final KOH etch

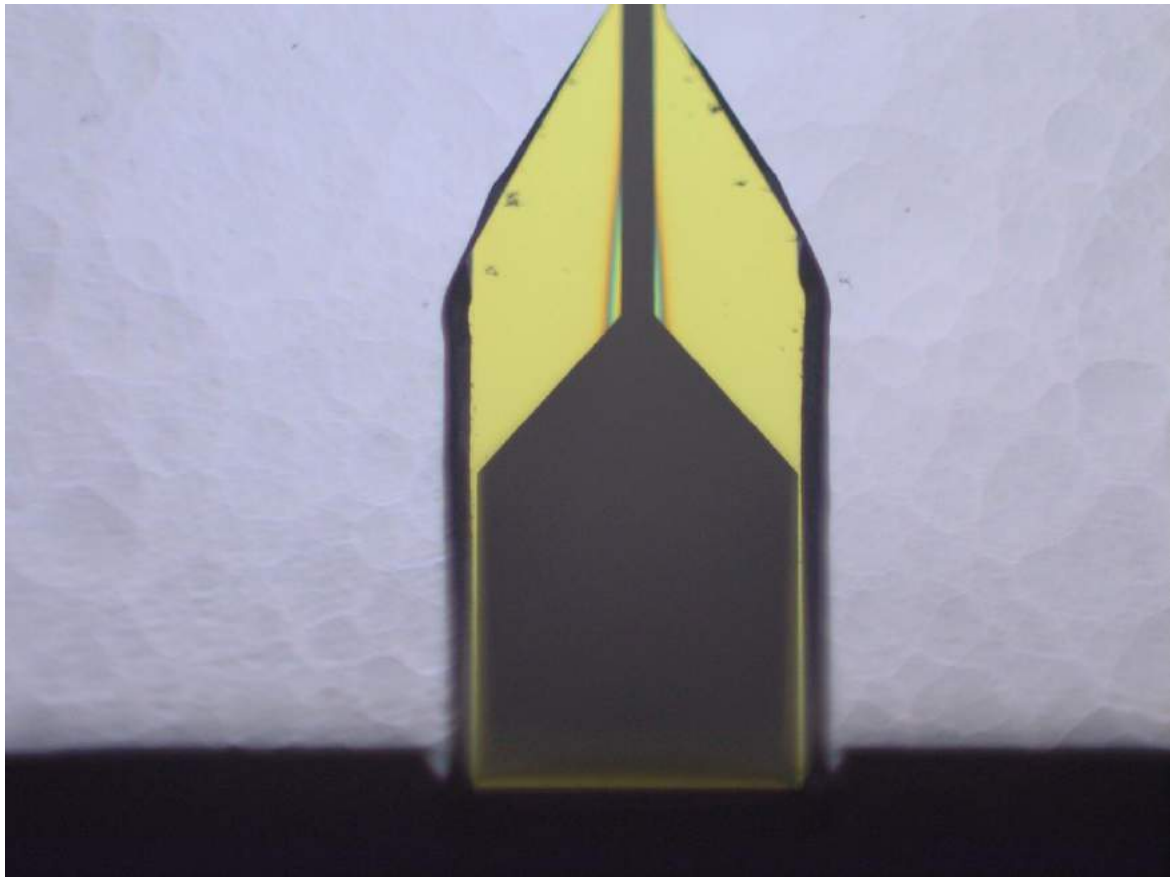


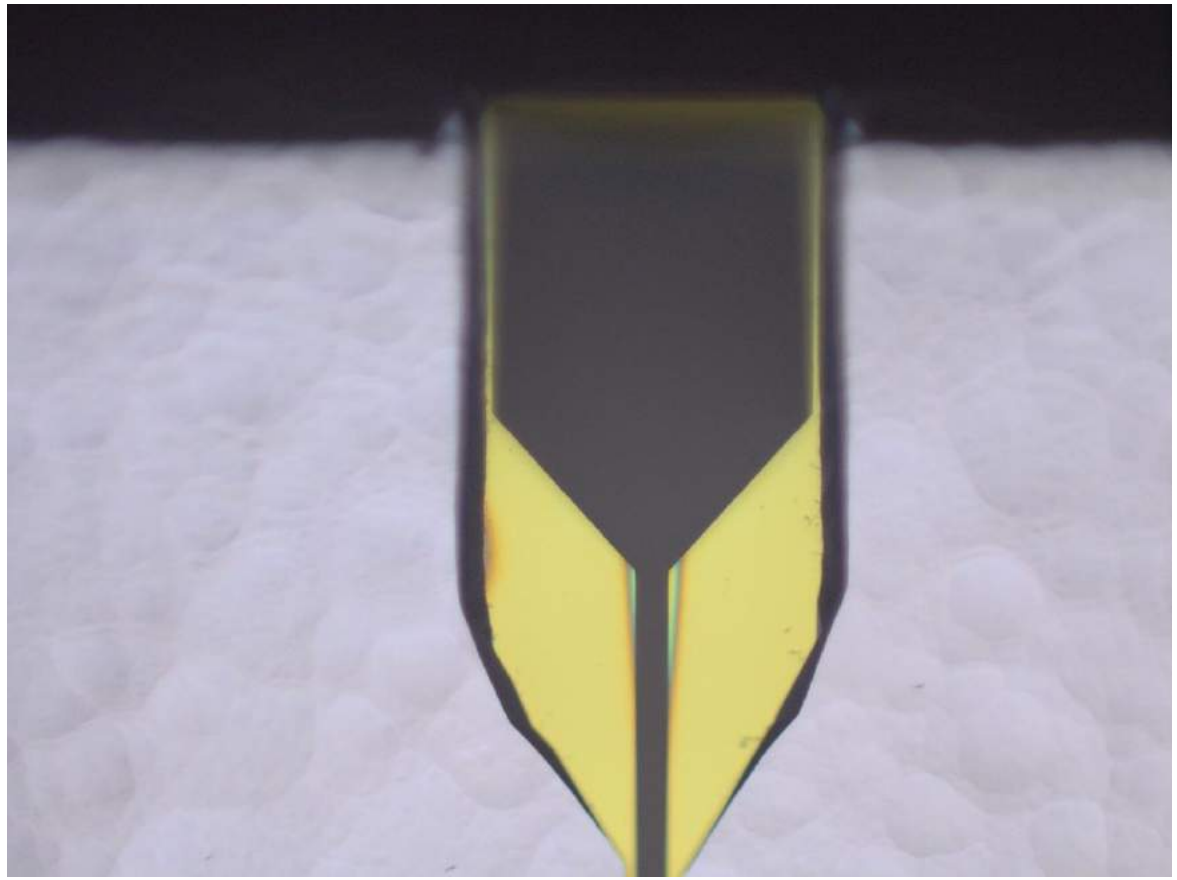


After Final KOH etch

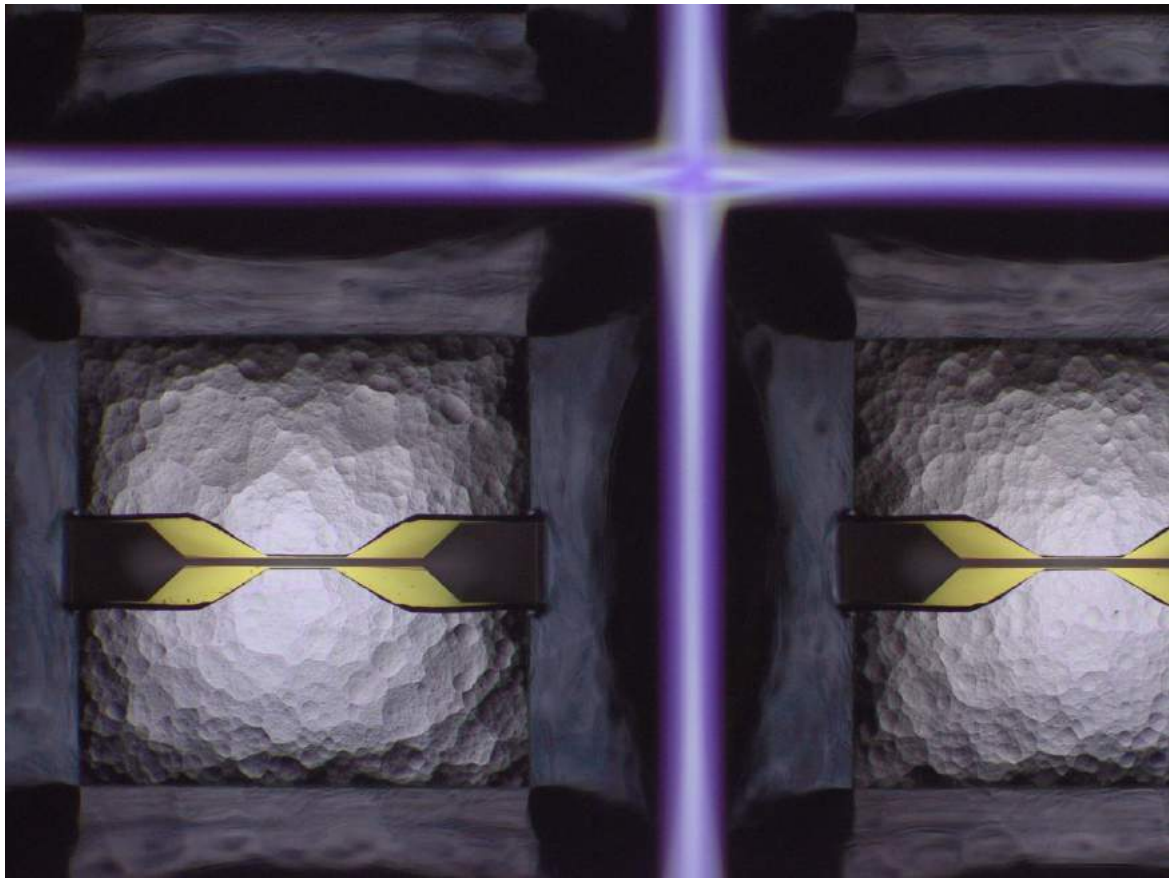


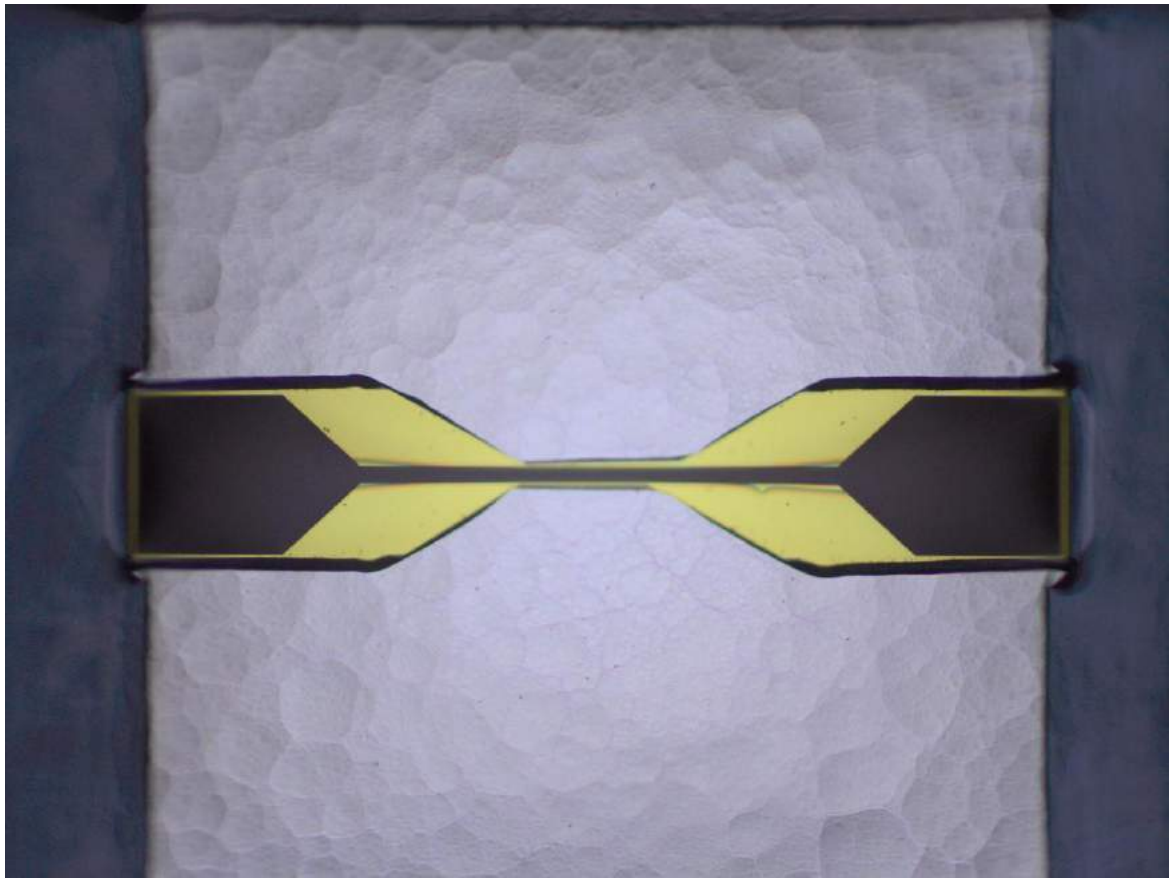
After Final KOH etch



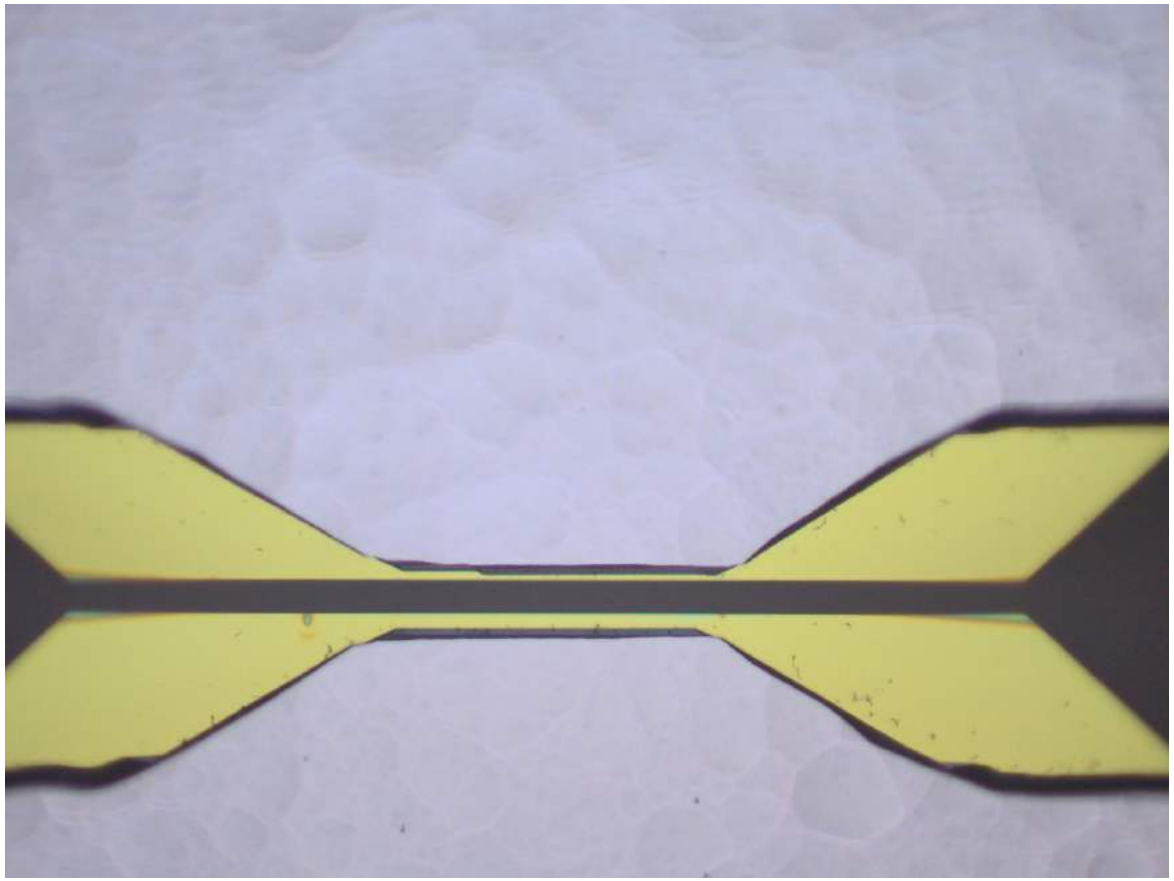


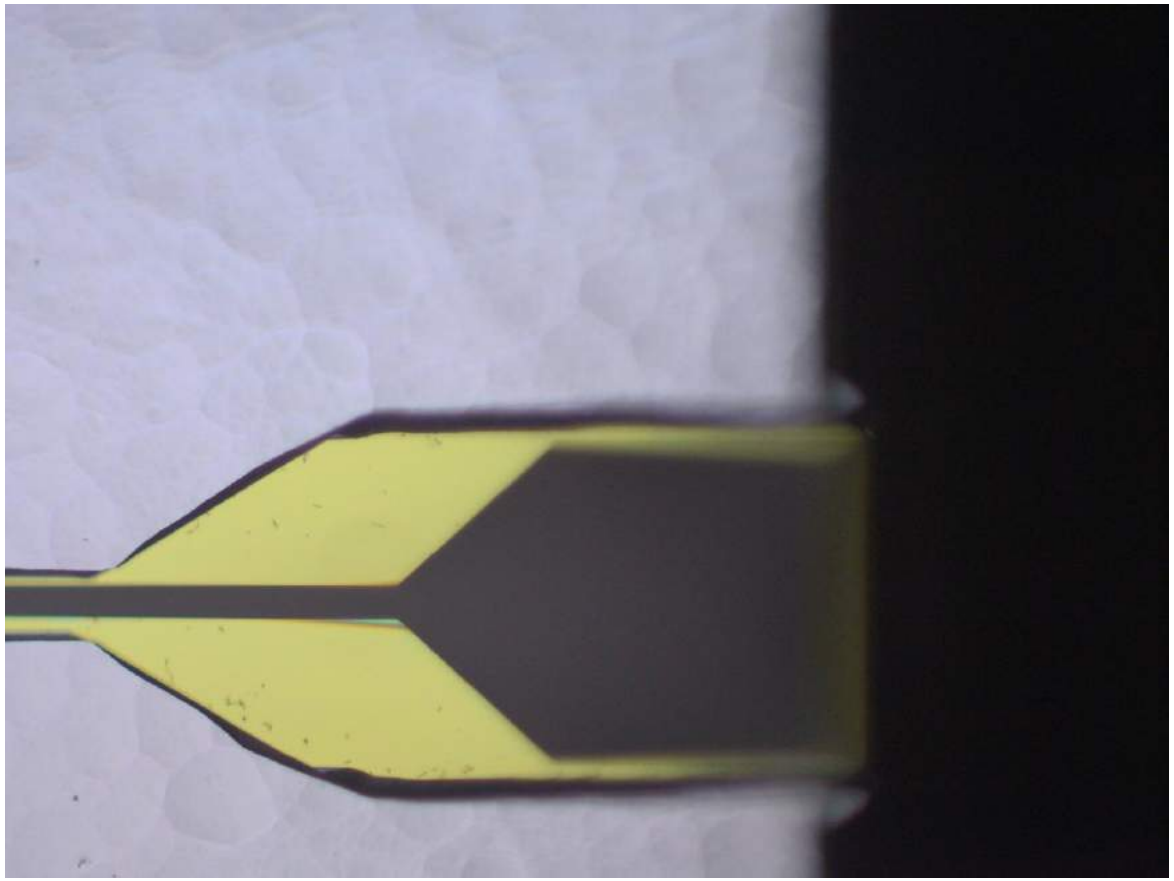
After Final KOH etch



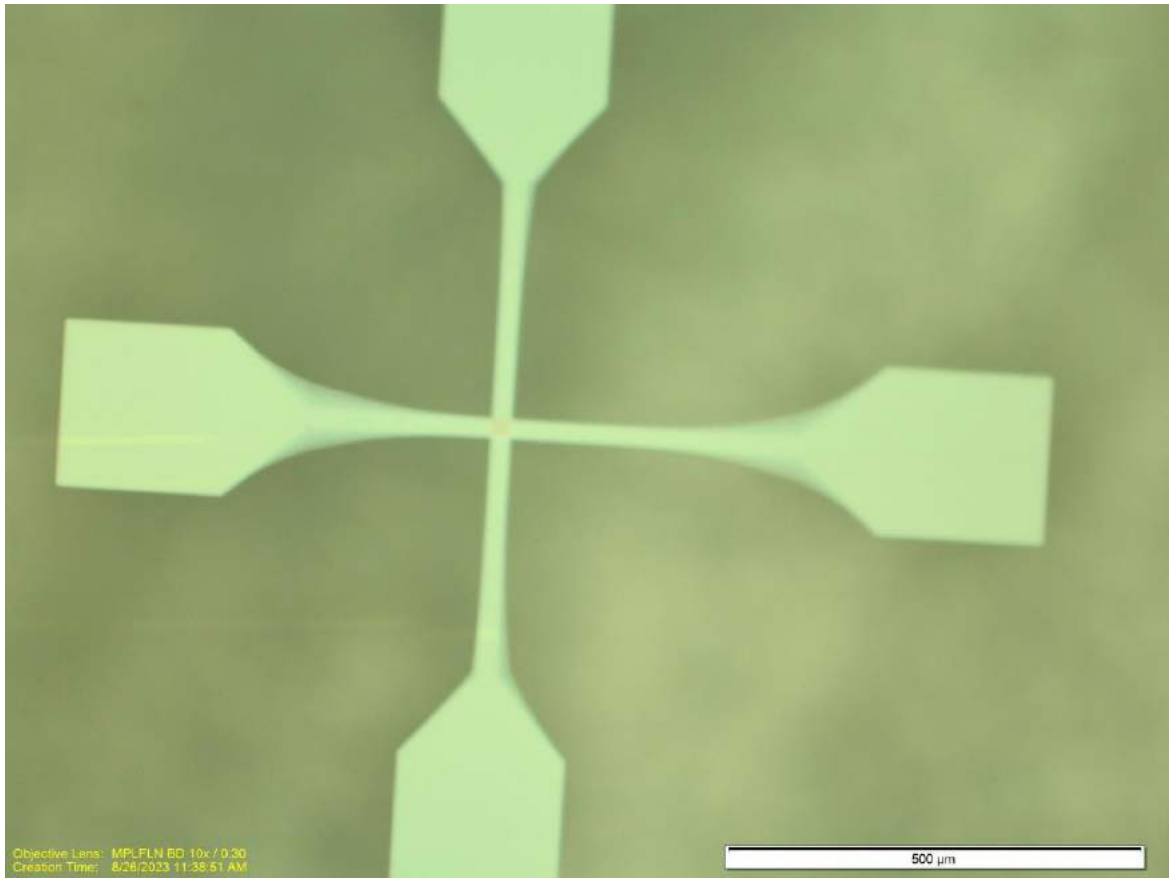


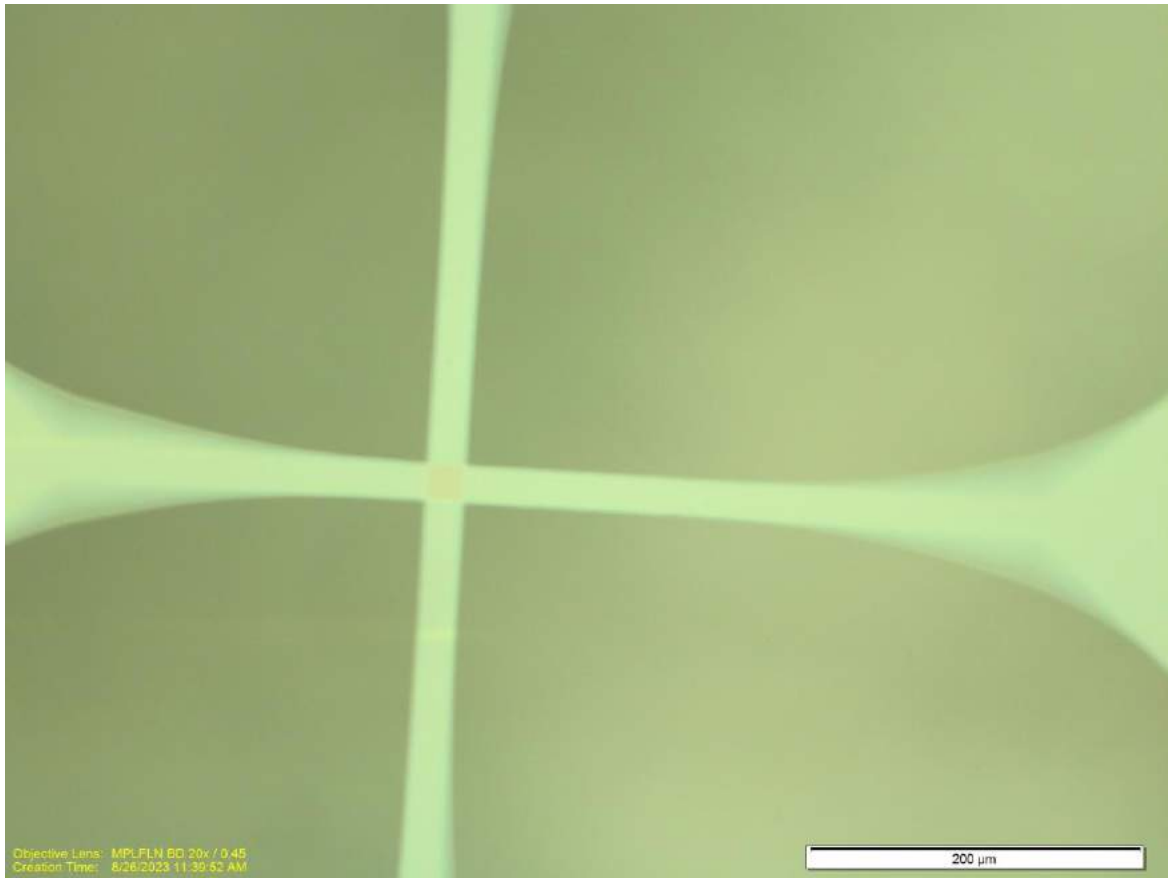
After Final KOH etch





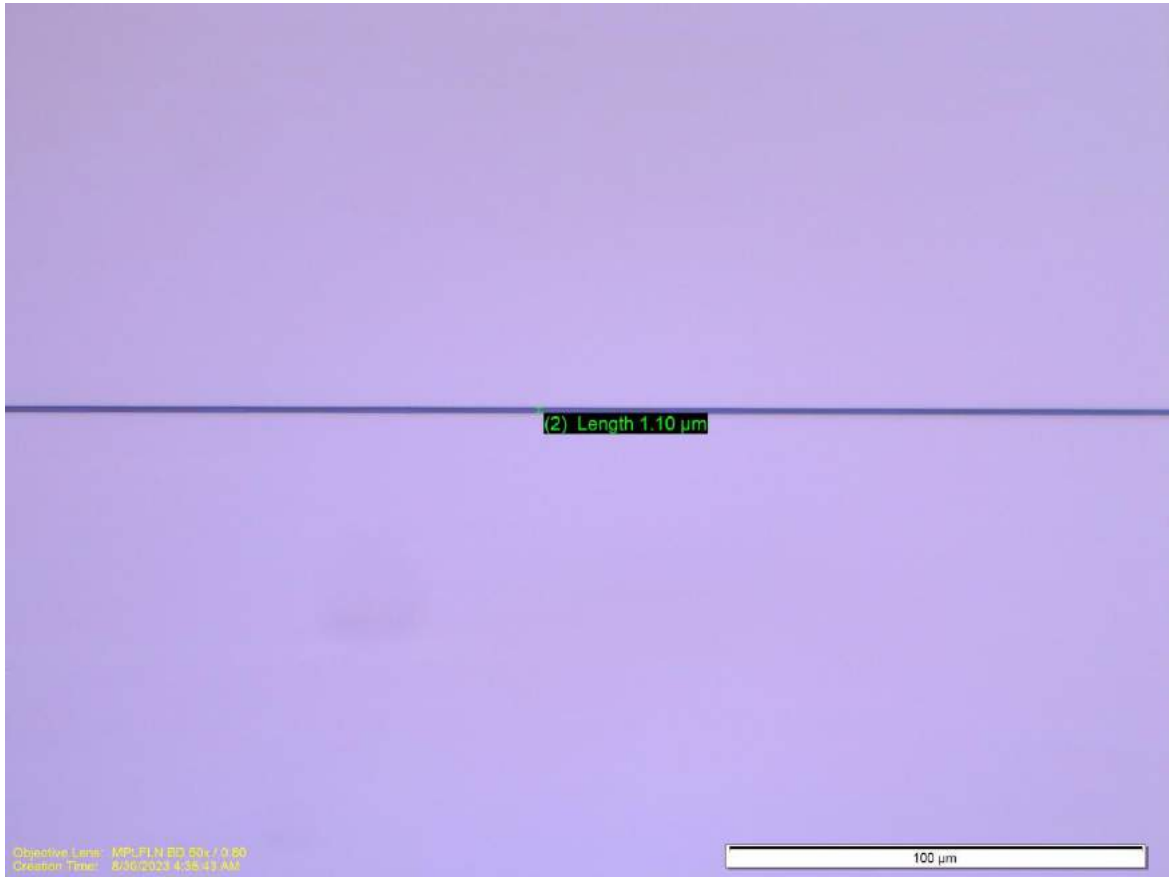
Growth of Ta/Ta2O5/Ta Josepshson Junctions

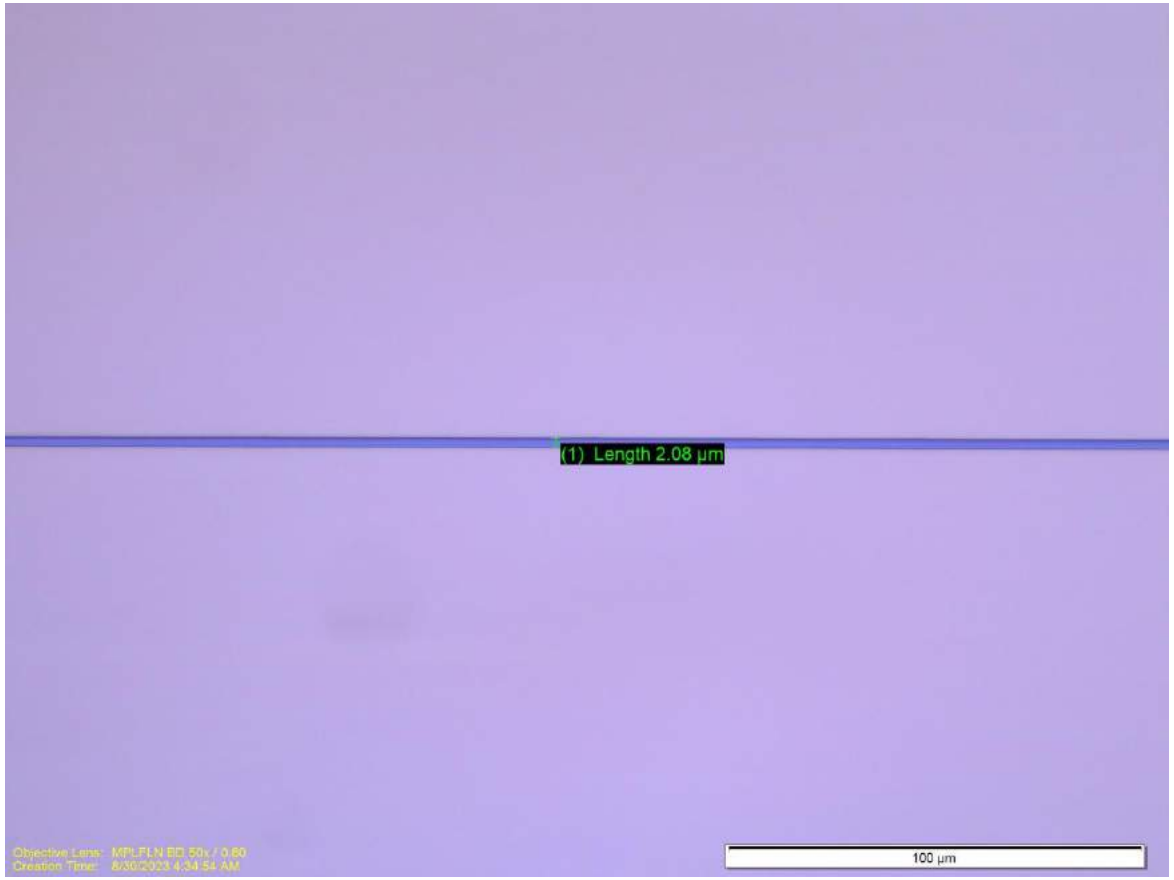




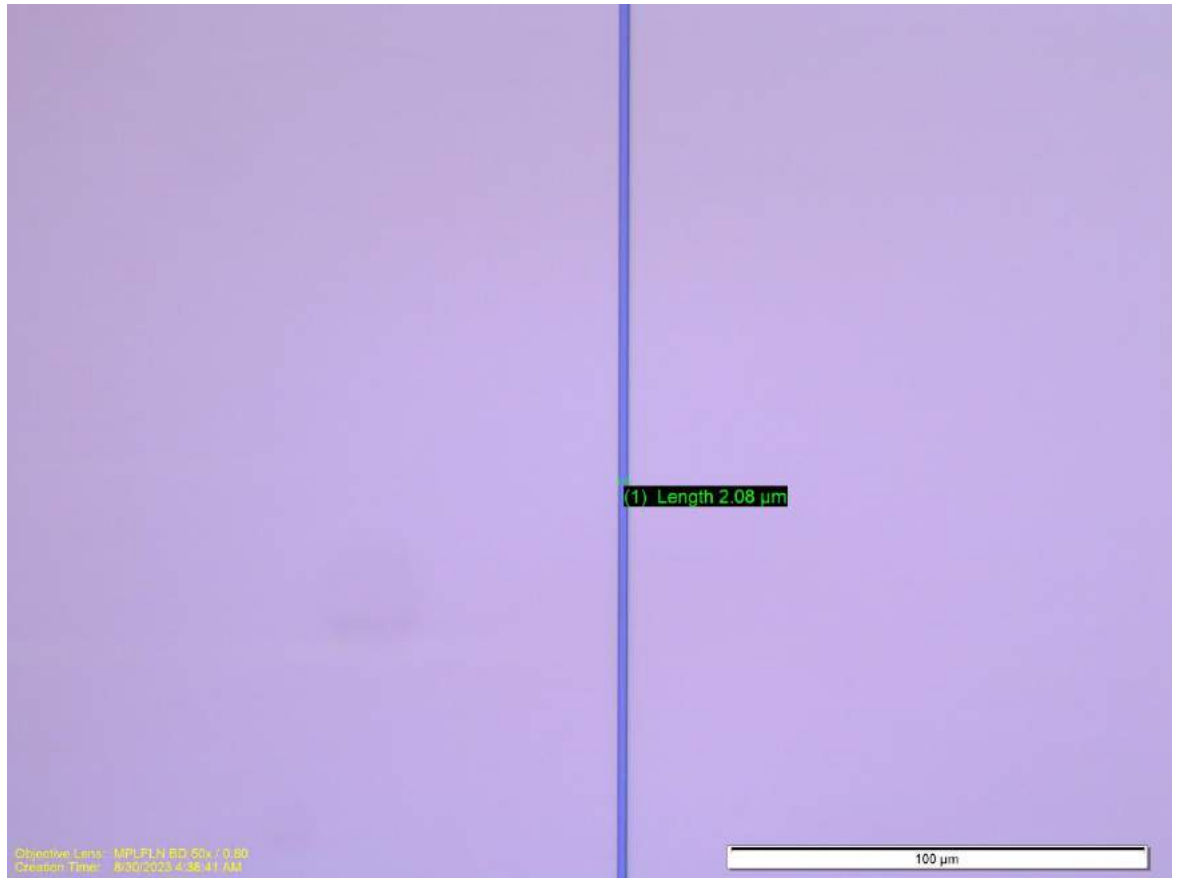
Growth of Ta/Ta2O5/Ta Josephson Junctions

Fabrication of Shadow mask 2

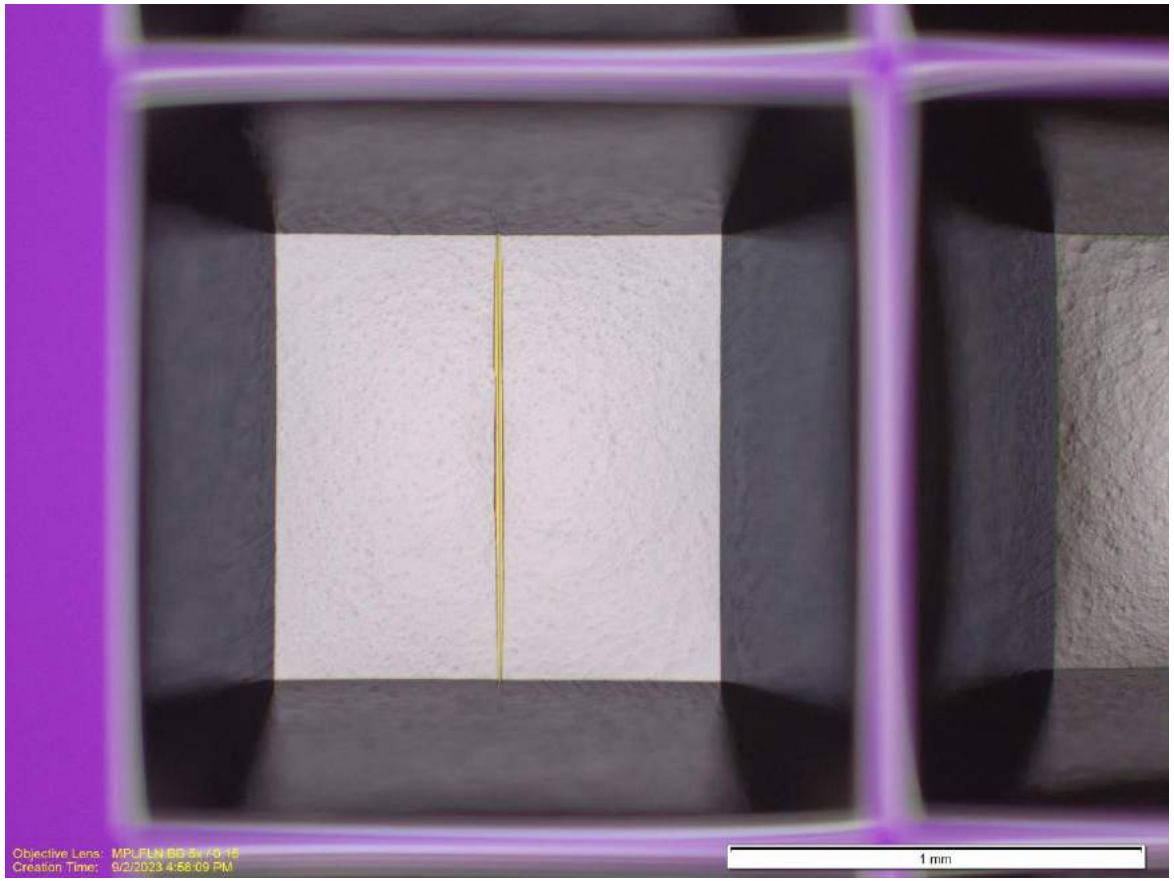


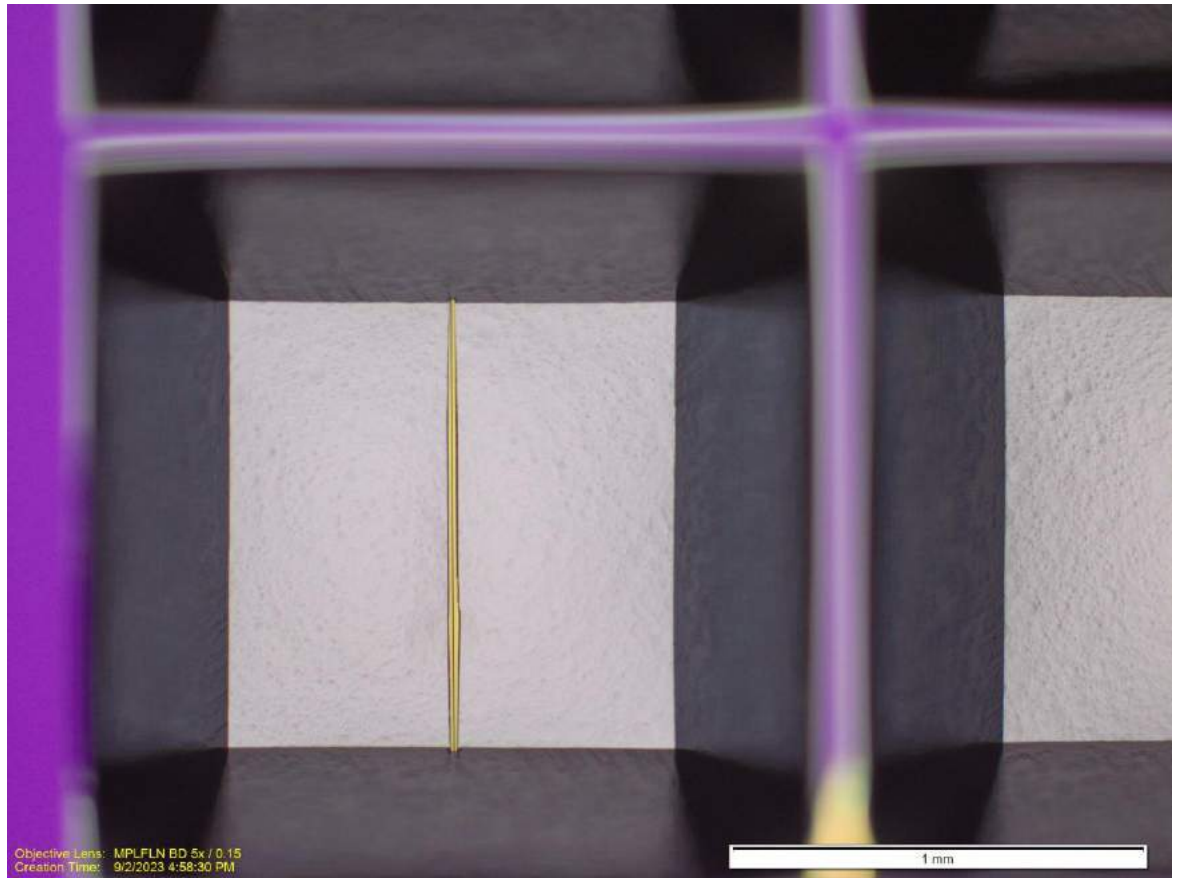


Shadow mask 3

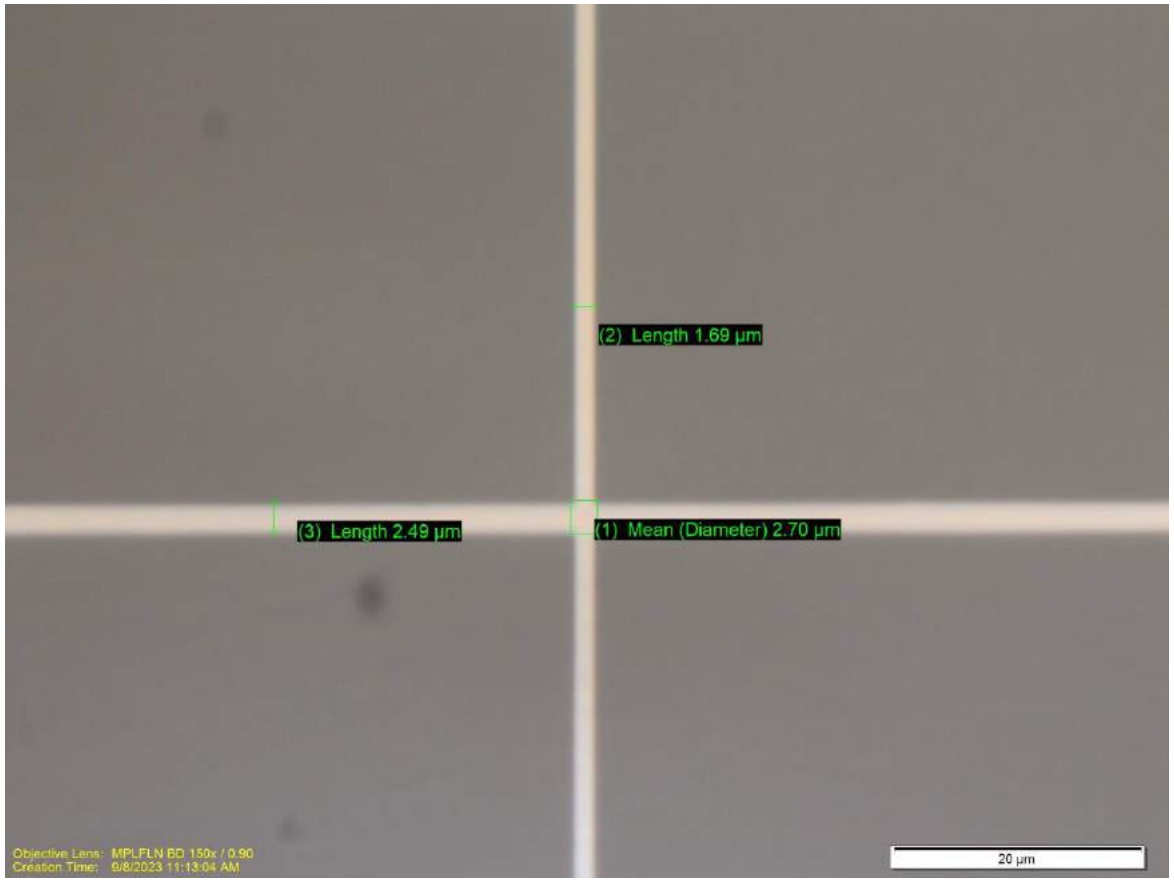


Shadow mask 3

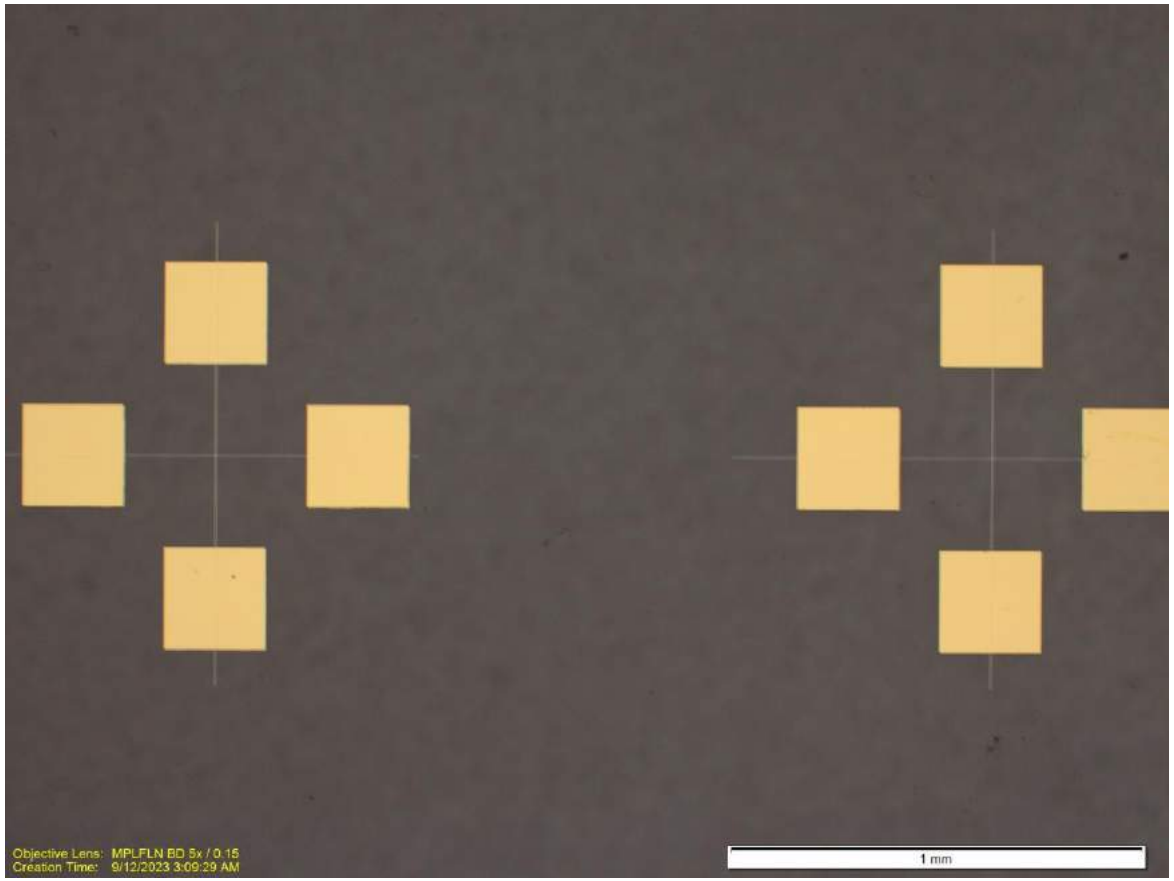


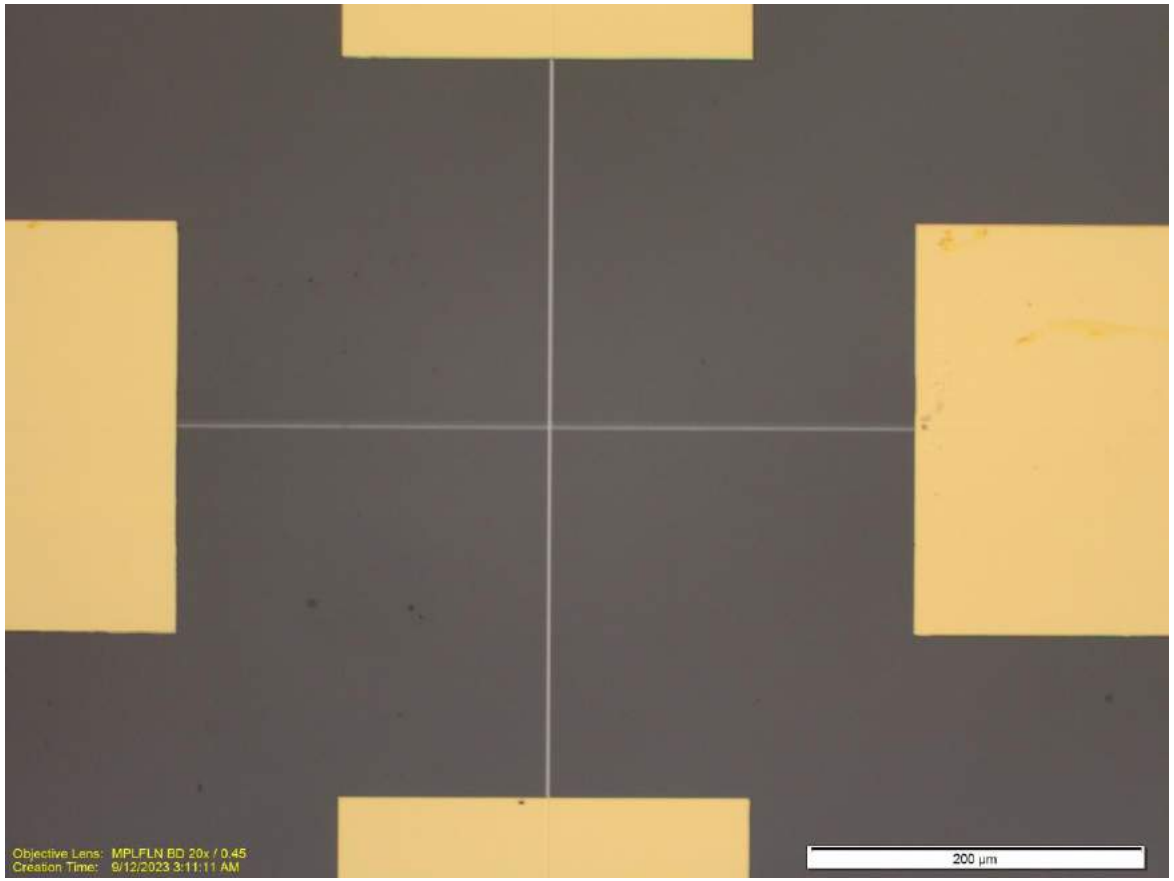


After Growth



Final Device





UC SANTA BARBARA