

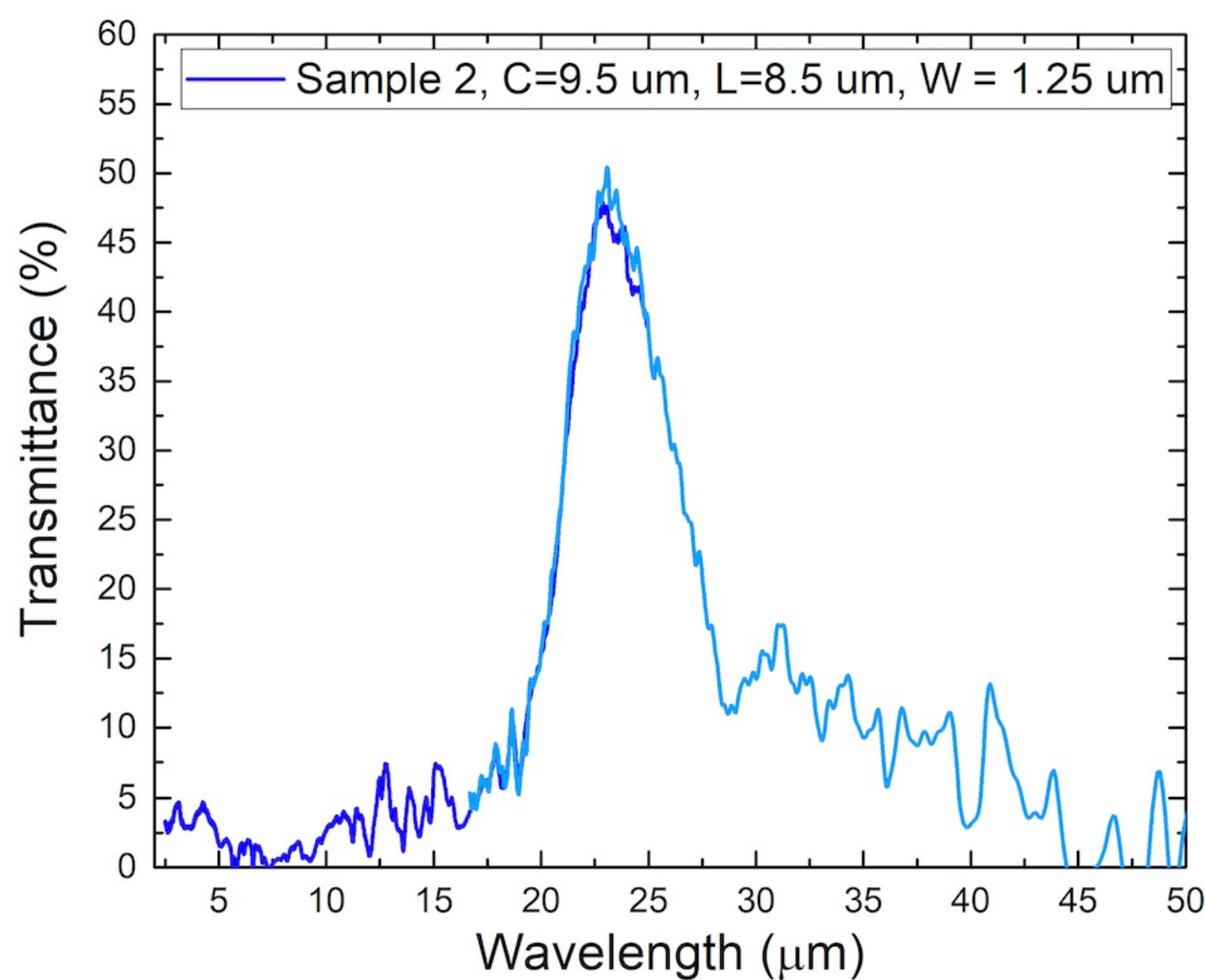
FY23 Innovative Spontaneous Concepts Research and Technology Development (ISC)

Far-infrared mesh filter development and characterization

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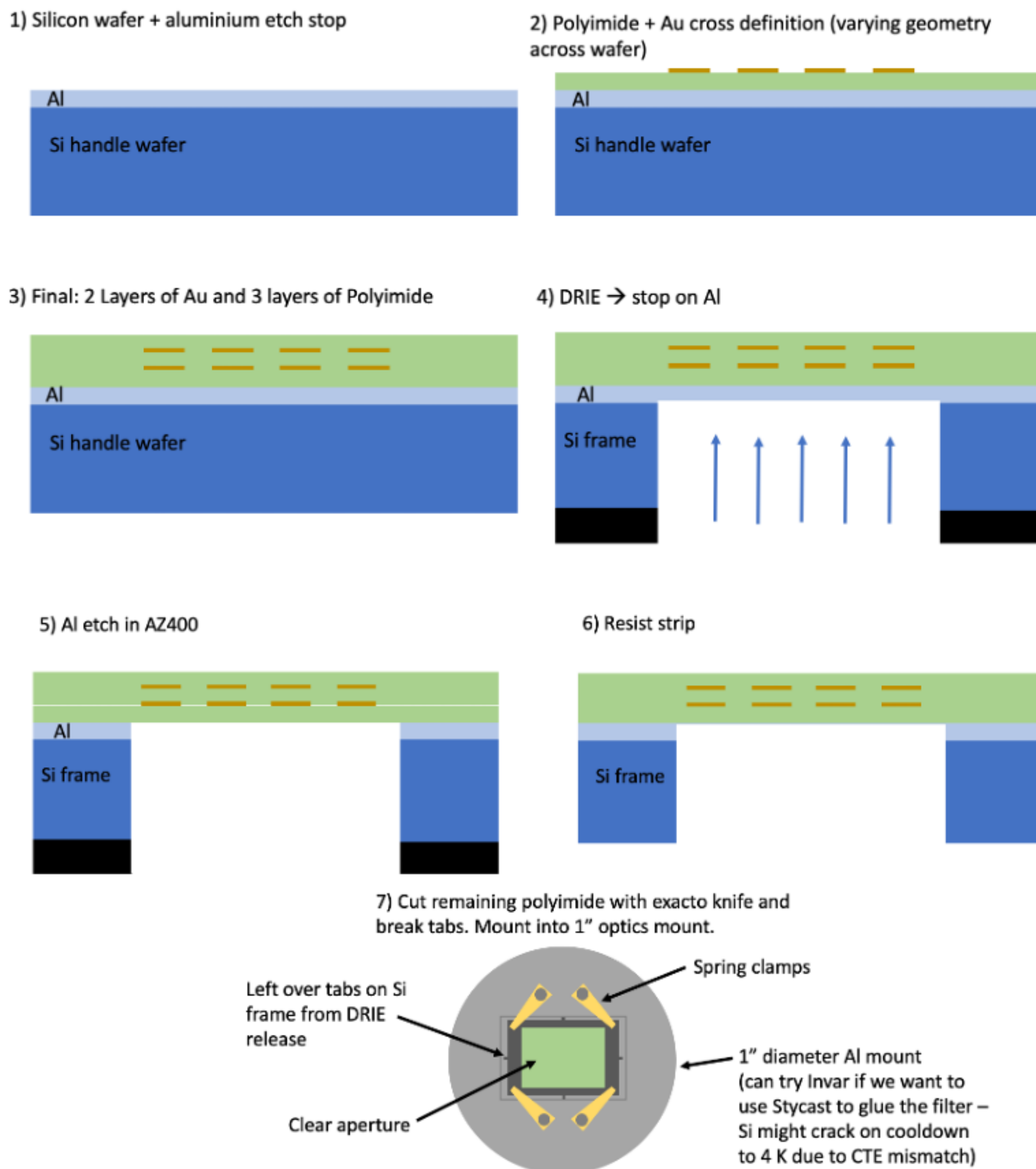
Objectives: Fabricate and characterize metal-mesh band-pass filters in the 25-40 μm region, which is the most lacking in commercial filter solutions. To make the process easily reproducible, spin-on polyimide was used on silicon substrates.

Background: Several detector technologies are currently being developed for far-infrared wavelengths ($>25 \mu\text{m}$). This includes superconducting technologies such as MKIDs, QCDs and SNSPDs, for applications in astrophysics, e.g. the PRobe far-Infrared Mission for Astrophysics (PRIMA), and the Balloon mission for Galactic and Infrared Science (BEGINS), and also dark matter searches. Multi-layer metal-mesh filters are an attractive solution at these wavelengths, but are not readily available. We set out to develop an in-house capability of filter fabrication and characterization at the Microdevices Laboratory (MDL).

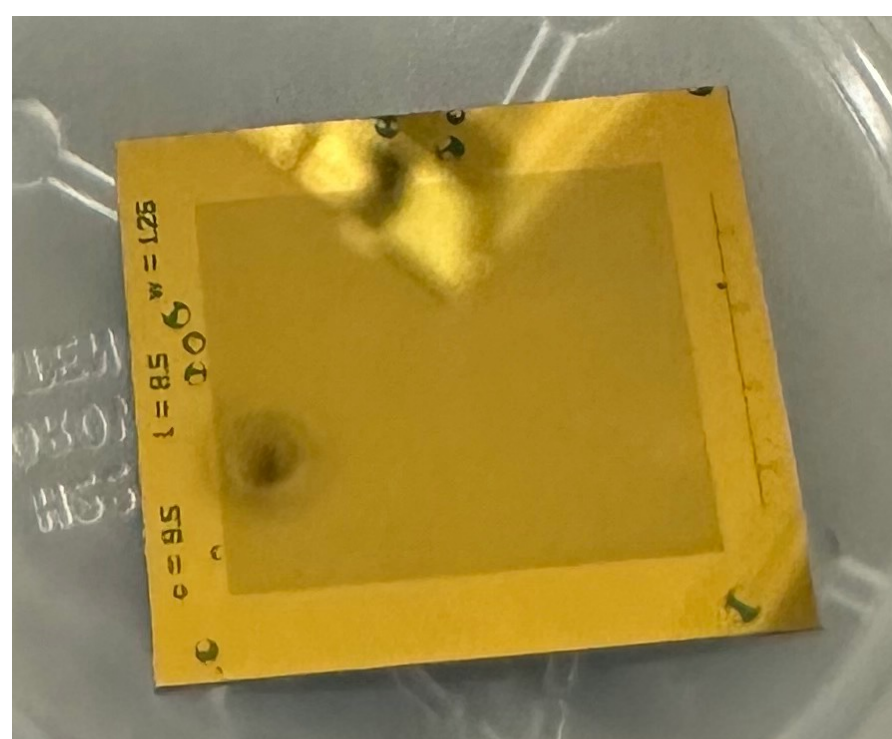


Transmission through one of the fabricated band-pass filters designed for 23 μm .

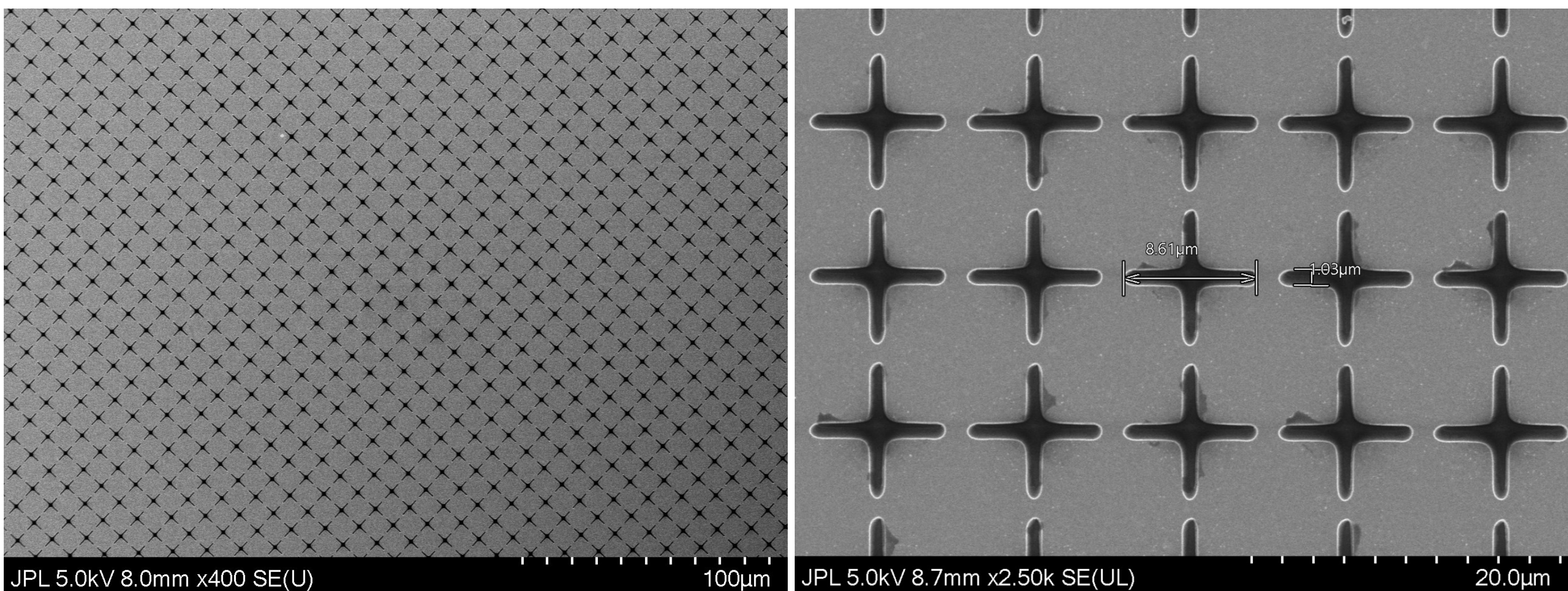
Broadband / variable band-pass version
Targets on the same wafer: 25, 30, 35 μm



Proposed process for suspended metal mesh filters, which will enable linear variable filters



Completed filter, with solid silicon and an anti-reflection coating



Scanning electron-beam image of metal mesh filter, demonstrating 1 μm resolution. Cross-shaped holes in a gold film act as a band-pass filter, while a square would correspond to a long-pass filter.

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