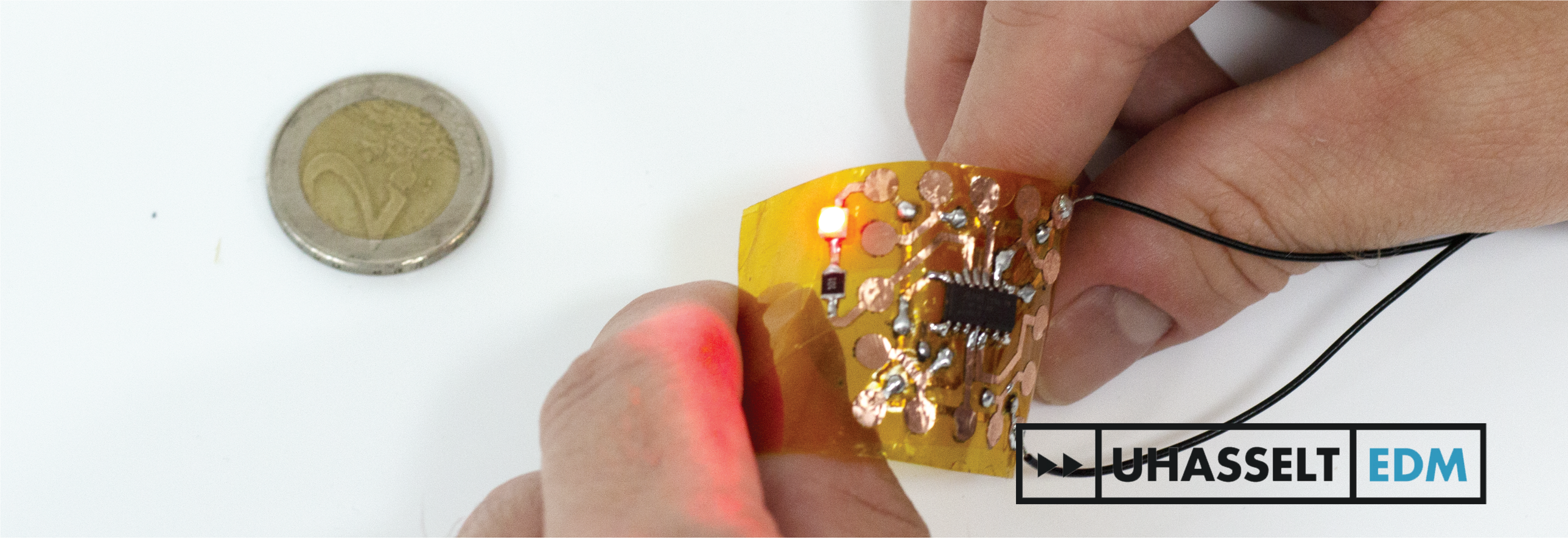

DIY Fabrication of High Performance Multi-Layered Flexible PCBs

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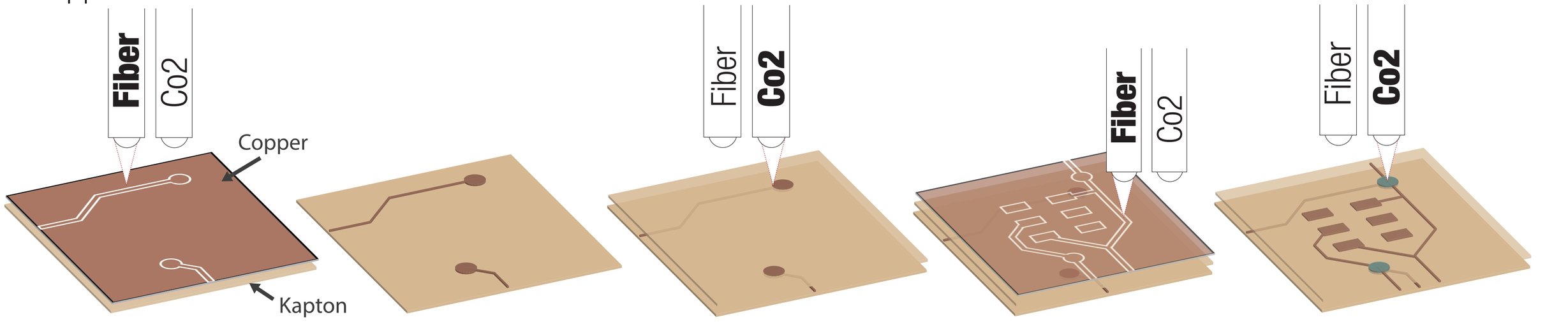
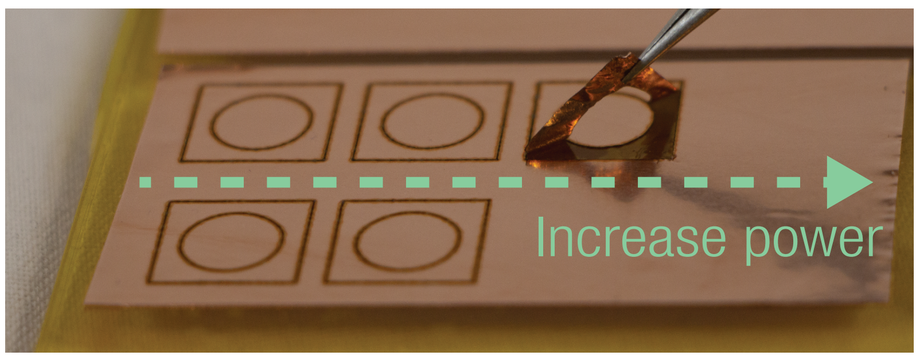
We present a novel DIY fabrication workflow for prototyping highly ***flexible circuit boards*** using a laser cutter. As our circuits consist of ***kapton and copper***, they are highly conductive and thus support high-frequency signals, such as I2C. Key to our approach is a laser machine that supports both a ***CO2 laser*** as well as a ***fiber laser*** to precisely process respectively kapton and copper. We also show how to ***laser cure solder paste*** to realize VIAs and solder components. In contrast, previous approaches for prototyping flexible PCBs through laser cutting only considered CO2 lasers which can process metals. Therefore these approaches mainly used ink-based conductors that have a significantly higher resistance than copper.

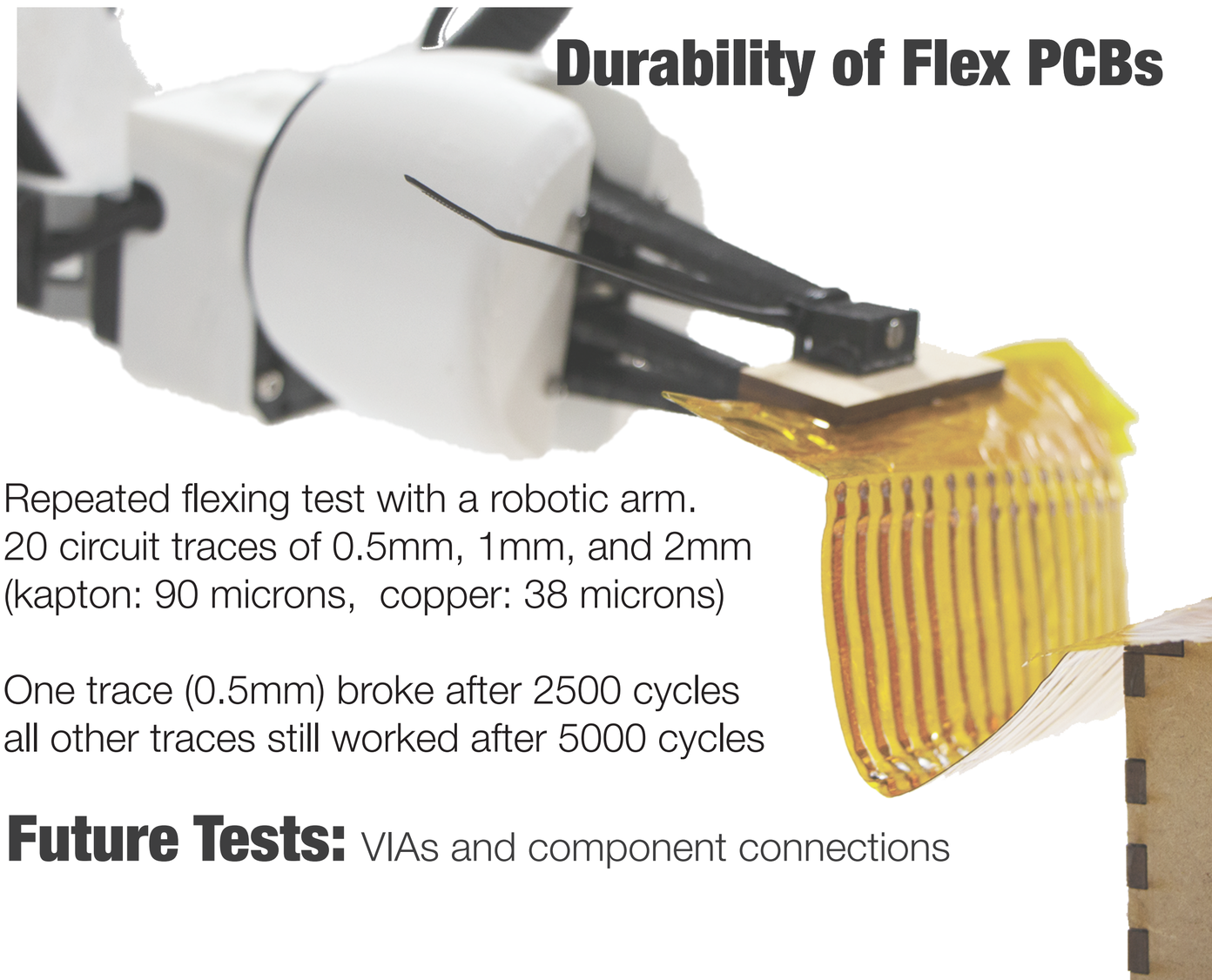


Calibrating Laser Power



To precisely cut copper without cutting the kapton below, we calibrate the power of the fiber laser. This process starts with laser cutting a circle inside a slightly larger square. The power is increased until the square can be peeled off while the inner circle remains attached. The CO2 laser does not require calibration as this laser is transparent to the copper below the kapton.

Durability of Flex PCBs



Repeated flexing test with a robotic arm.
20 circuit traces of 0.5mm, 1mm, and 2mm
(kapton: 90 microns, copper: 38 microns)

One trace (0.5mm) broke after 2500 cycles
all other traces still worked after 5000 cycles

Future Tests: VIAs and component connections