# Technical Data Sheet

## Laser Direct Writer

## UVW02

SEJONG
SCIENTIFIC INSTRUMENTS

# SPECIFICATION
# MASKLESS LITHOGRAPHY
# LASER DIRECT WRITER
# UVW02

## Product Information

- Photolithography for various devices
  - Manufacturing unit devices for research
  - Semiconductor devices, solar devices,
  - Microfluidic channel, lab-on-a-chip
- Optical microscope + 405 nm laser focus
- Objectives: 5x, 10x, 20x, 50x, 100x
- automatic switching
- Laser focus, sample focus switchable
- Autofocus function included as standard
- hardware: XYZ motorized micro-stage and optical microscope
- image writing software: open black-and-white image files with pattens and write the pattern like a pen, tracing shortest paths
- vector line drawing: The user draws lines directly with the mouse while looking at the microscope image of the board, and the scanner draws a pattern along these lines.
- 2 writing modes: area filling with low resolution + line drawing with high resolution
- Photoresist: compatible for general optical lithography PR
- Applications: solar cell electrodes, big electrodes in micro-device, contact pad for device, microfluidics device, lab-on-a-chip
- Image pixels: 1000 x 1000
- sample stage tilt correction

## Specification

- Minimum linewidth: ~1 μm
- minimum spot size: 1 um
- maximum writing speed: 600 um/sec
- Sample stage resolution: 0.125 μm
- Scannable range: 25 mm x 25 mm
- Focal depth: 1 μm

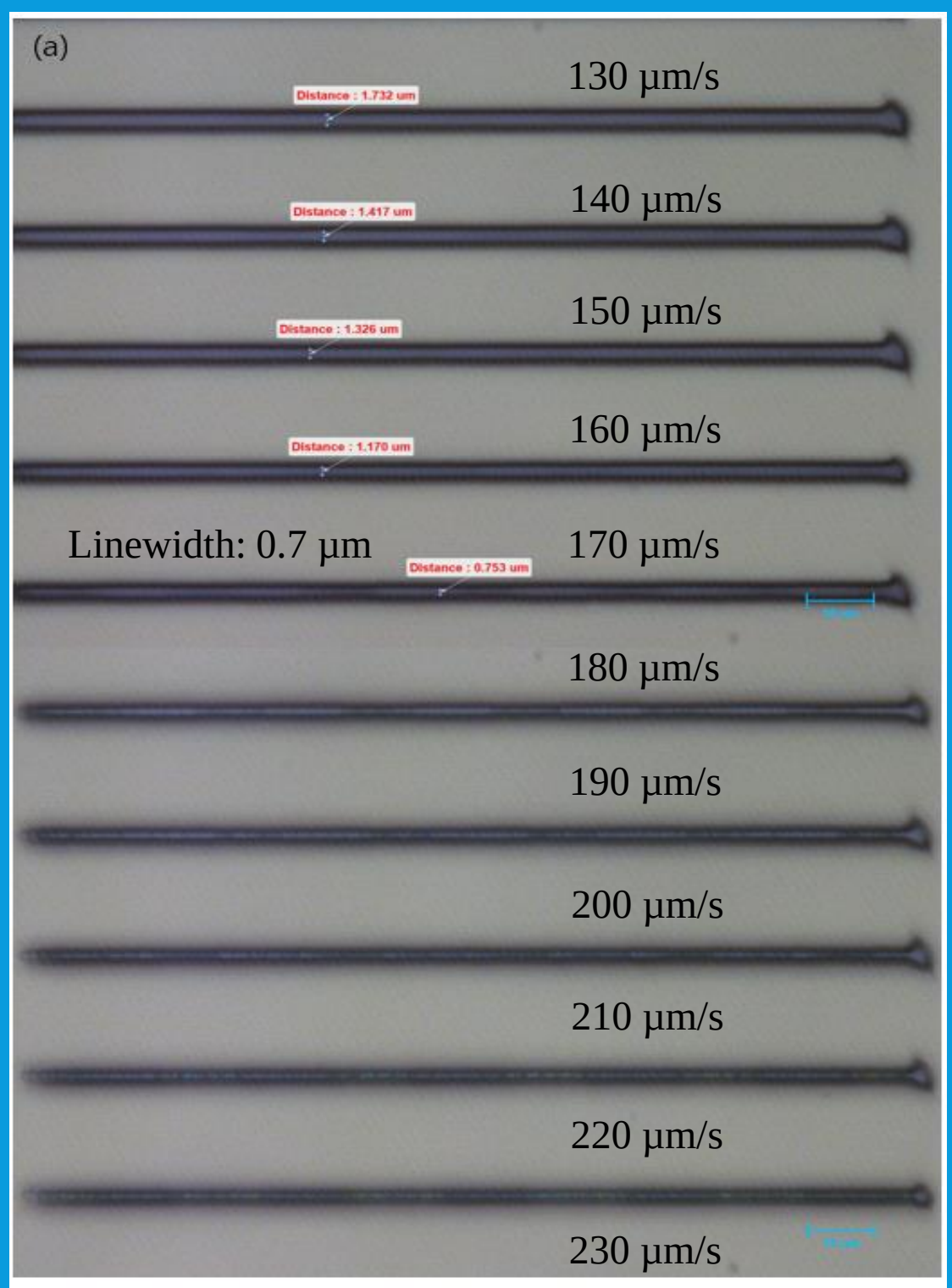
## convenience

- ✓ Auto-focusing!
- ✓ Large area scanning stage
- ✓ Magnet holder for electric lead contact
- ✓ Device protection using jumper wire on bread board
- ✓ Keyboard operation → position adjustment
- ✓ Mouse operation → move to a specific location on the sample
- ✓ Software zoom-in and zoom-out for line drawing
- ✓ 2 writing mode: Raster writing and Vector writing
- ✓ Raster writing: filling area after opening external image file
- ✓ Thick (thin) pen writing with high (lower) laser intensity
- ✓ Vector writing: line pattern writing drawn by mouse clicking

# EXPERIMENTAL DATA USING UVW02

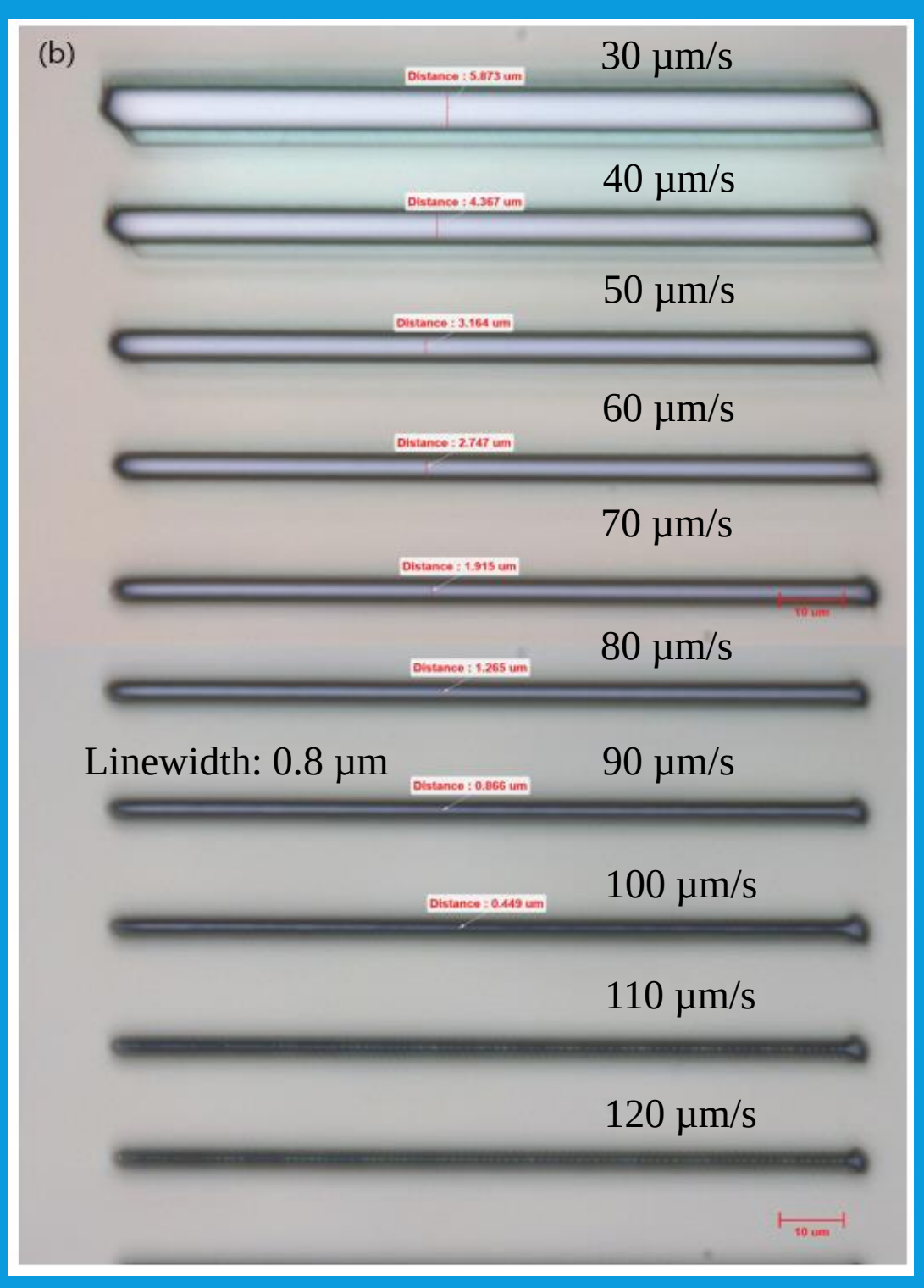
# LINEWIDTH VS. WRITING SPEED

## Laser power: 760 nW




(a) linewidth with changes in laser velocity, ranging from 130-220 µm/s, while maintaining a constant laser power of 760 nW. At a velocity of 170 µm/s and the specified laser power, the line width narrows down to approximately 0.7 µm.

## Laser power: 590 nW




(b) The drawing speed from 30- 120 µm/s, with the laser power constant at 590 nW. At a speed of 90 µm/s at this laser power, the resulting linewidth measures about 0.8 µm

# WRITING SPEED VS. LASER POWER ANALYSIS

- Photoresist used: PR (AZ® GXR-601-46 cps) spin-coating at 4000 rpm → 90 °C soft baking

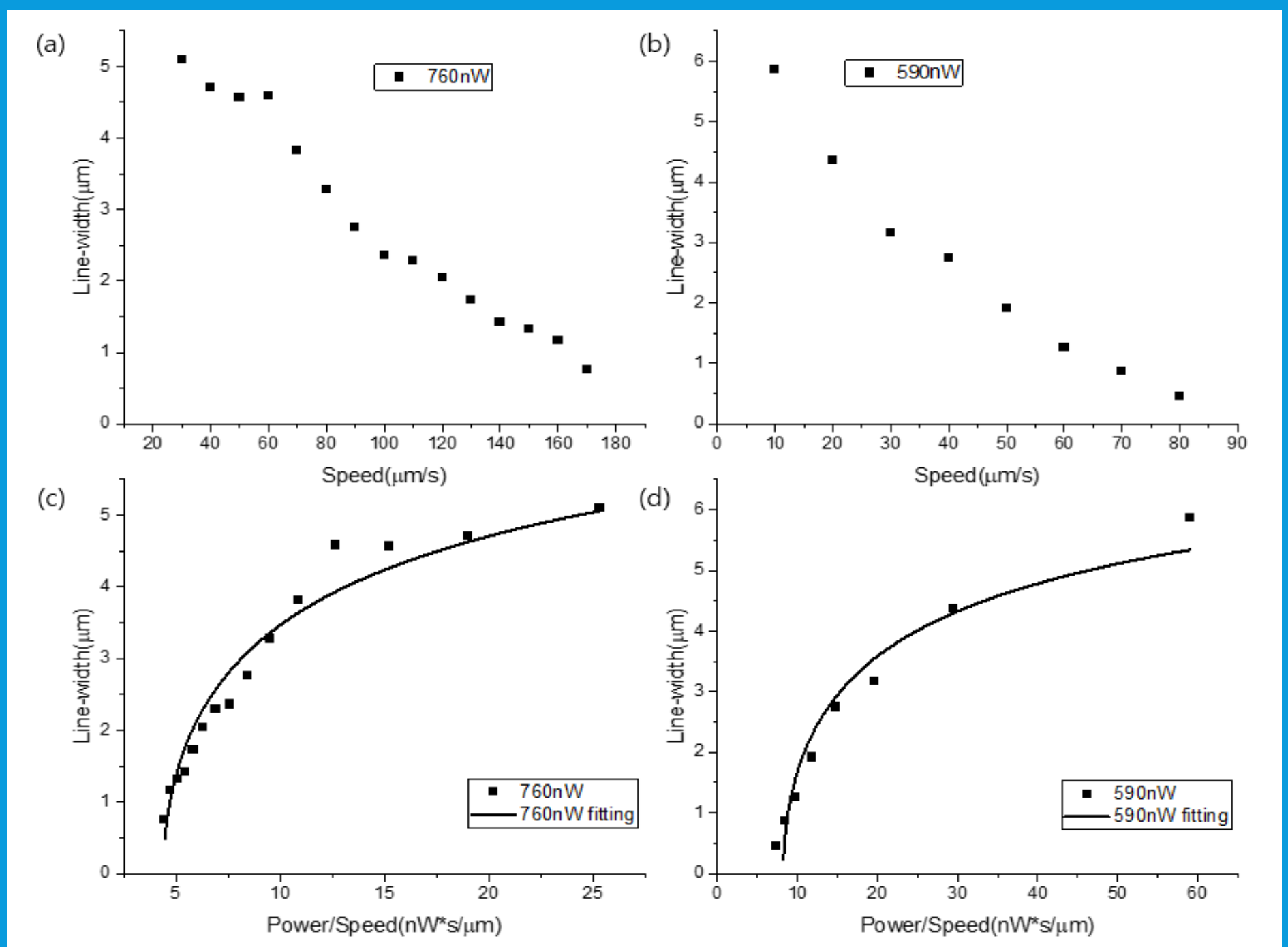



**Figure 2** (a-b) The correlation between drawing speed and linewidth at laser power of 590 nW and 760 nW, respectively. (c-d) demonstrate the relationship between linewidth and the power-to-speed ratio for 590 nW and 760 nW laser powers, respectively.

# LIFT-OFF PROCESS FOR ELECTRODE PATTERNING ON $MOS_2$

- bilayer photoresist used: polymethylglutarimide (PMGI, SF9) resist  spin-coating at 4000 rpm → soft bake @ 160-210 °C → PR (AZ® GXR-601-46 cps) spin-coating at 4000 rpm  → 90 °C soft baking

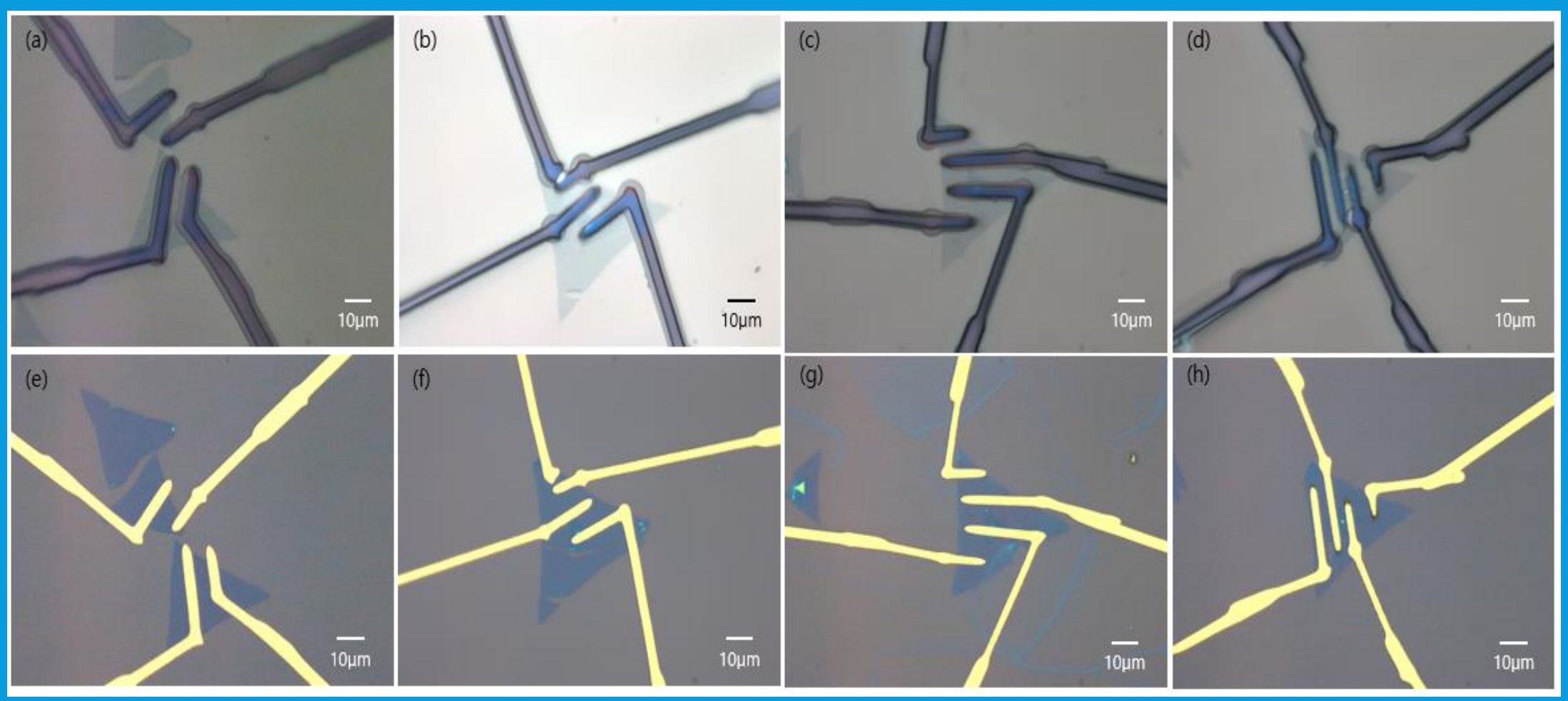



**Figure 3.** (a-d) Electrode patterning on a $MoS_2$ sample, ~30 μm in size, using maskless lithography. These micrographs were taken after development. (e-h) Micrographs of the final devices are shown after the lift-off process. Deposition of 10 nm of Bi, succeeded by the deposition of 40 nm of Au using an E-beam evaporator.

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