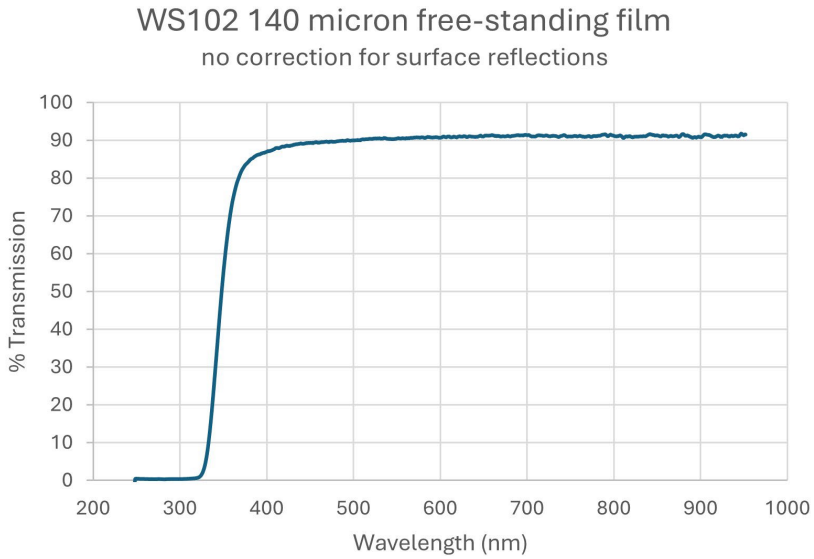
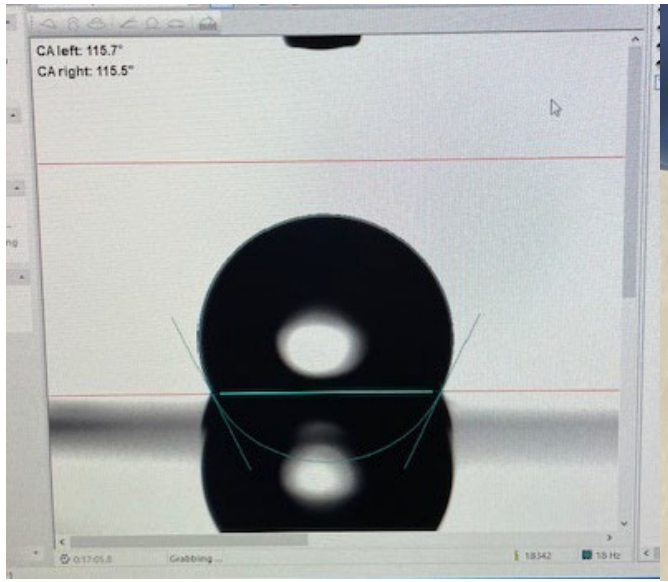
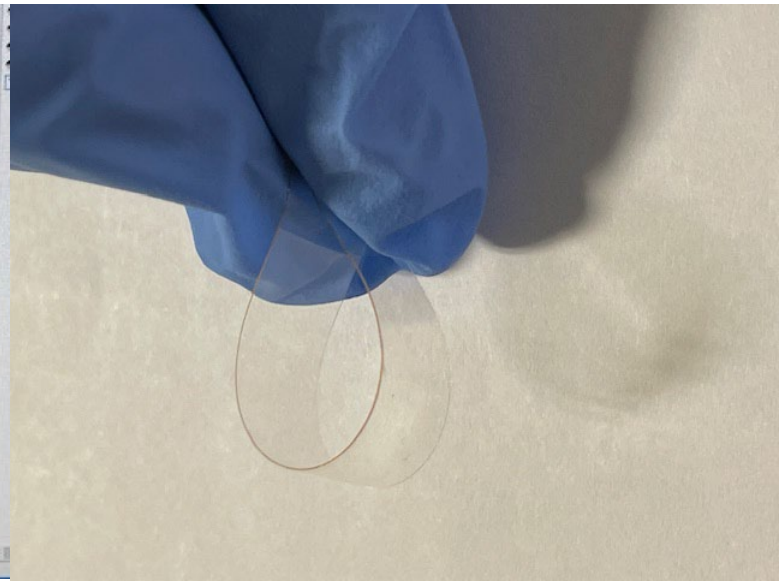
Addison Clear Wave's
PFAS-free Epoxy Working Stamp Resins







Advantages of Epoxy Working Stamp Resins for UV Lens Molding

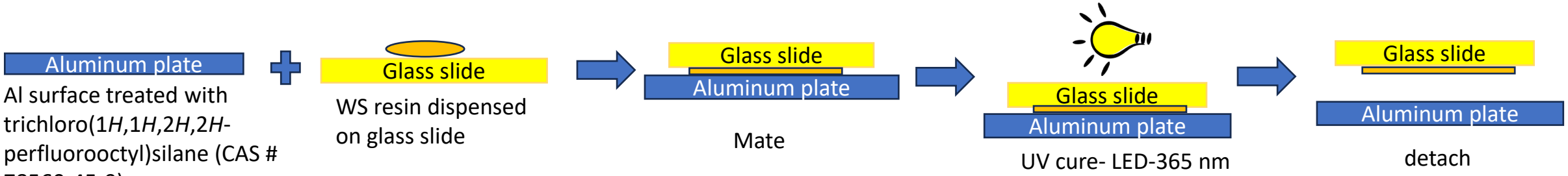
- Fluorine-free material: environmentally friendly
- ANTI-STICK layer on working stamp NOT required
  - Reduces number of process steps
- Excellent CHEMICAL RESISTANCE
  - Resistant to etching power of aggressive imprint resins
  - Minimizes height gain on multiple imprints
- Epoxy chemistry eliminates grafting with acrylate imprint resins
  - Easy detachment of cured imprints from working stamp

ACW testing of Epoxy WS resins

- Testing epoxy working stamps with ACW's imprint resin L2002-C56
- 2 grades of epoxy working stamp resins
  - WS-101 is harder than WS-102
  - Both give tough, strong films with high flexibility
  - Both transmit 365 nm light, WS-102 transmits more 365 nm light
- Test plan for UV lens molding with L2002-C56 imprint resin
  - Step 1: test release of working stamps from metal surface
    - Using conventional anti-stick material for release from metal
  - Step 2: test release of L2002-C56 imprints from working stamps
    - No release agent used in this step

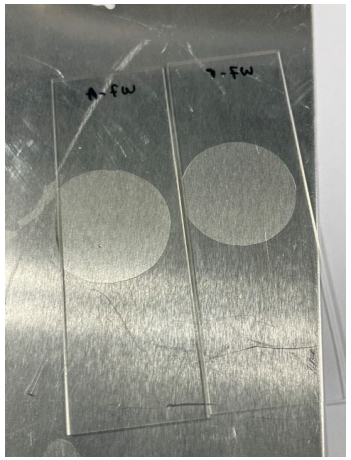
Laboratory test of WS-101 and WS-102

- Step 1: Test release of working stamps with glass backplane from metal



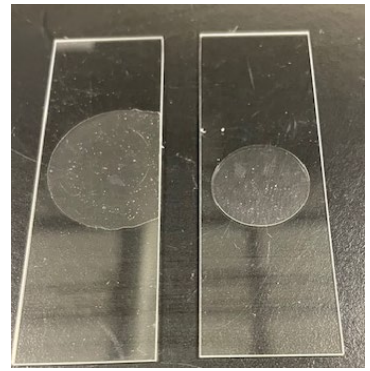
Treated Al surface with silane (CAS # 78560-45-9)
Al surface has roughness

WS-101 or WS-102 drop dispensed on glass slide



* UV: LED-365nm
250 mW/cm^2 x 200 sec
* Wait 3 minutes for sample to cool down to RT before detach

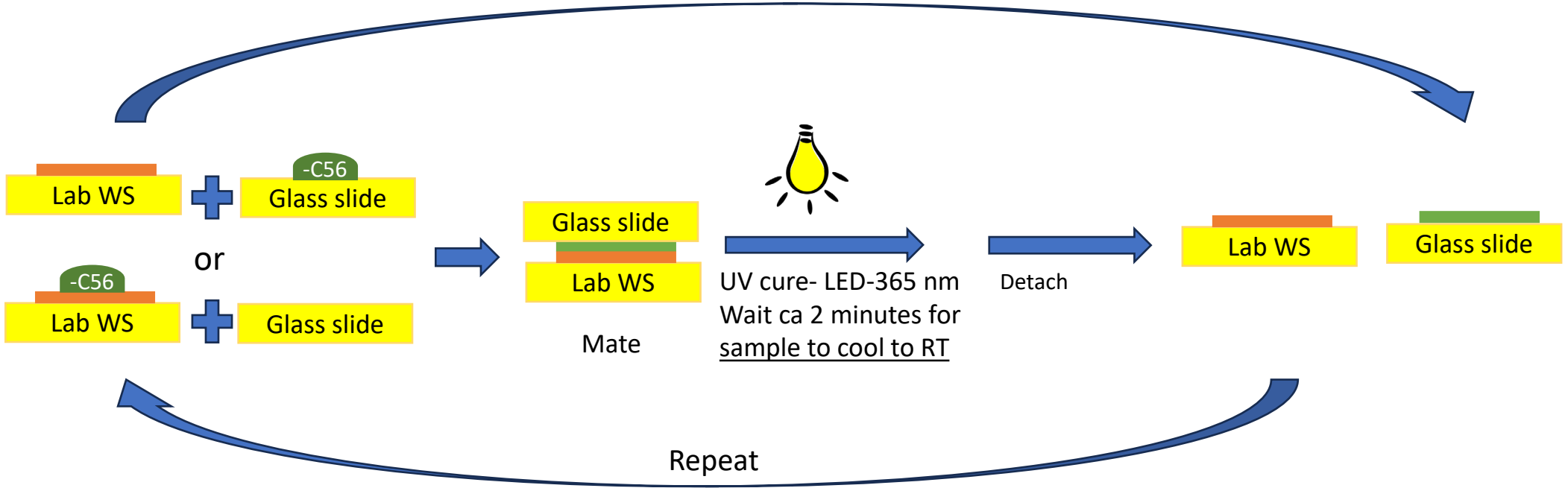
detach



Detached cleanly with little force
Roughness of Al surface replicated
ACW refers to these as Lab WS with glass backplane for step 2

Laboratory test of WS resins (continued)

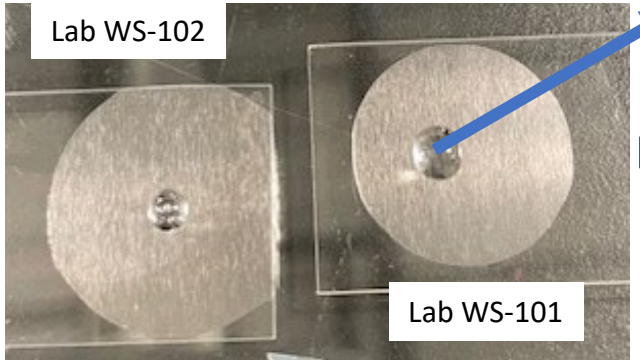
- Step 2: separation test for imprint resin L2002-C56



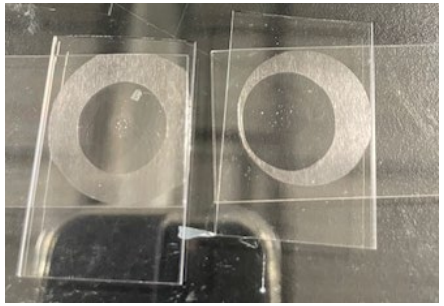
Laboratory test of WS resins (continued)

- Step 2: separation test for L2002-C56

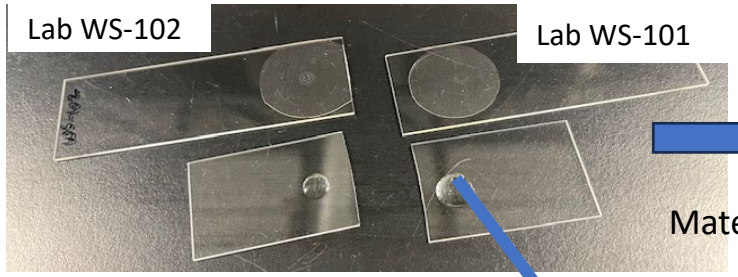
Dispense L2002-C56 on Lab WS



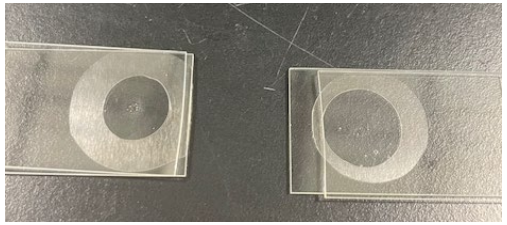
Mate



Or dispense L2002-C56 on glass slide

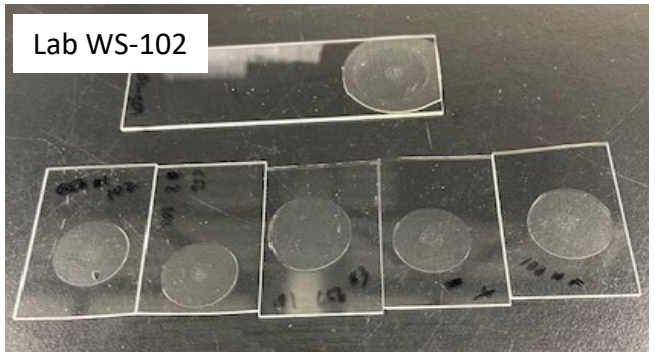


Mate

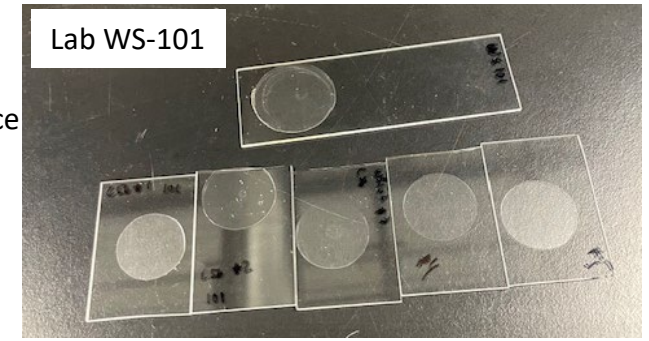


* UV: LED-365nm
250 mW/cm^2 x 50 sec
* Wait 2 minutes for sample to cool down to RT before detach

Detach: clean very little force repeat



5 imprints were made with –C56, detach cleanly with little force



5 imprints were made with –C56, detach cleanly with little force

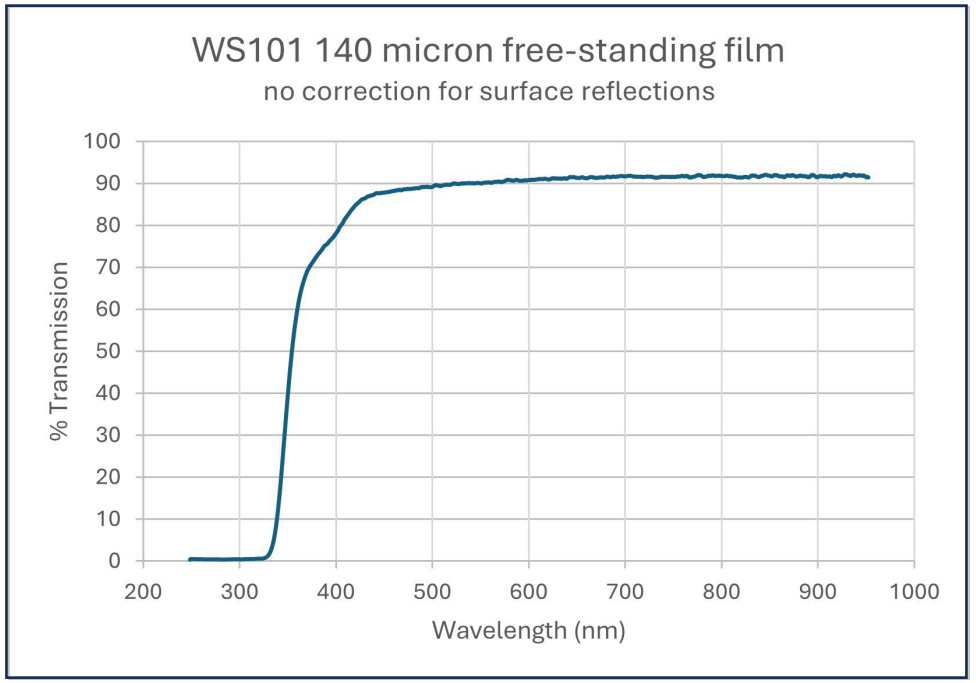
ACW's Epoxy WS Resins Characteristics

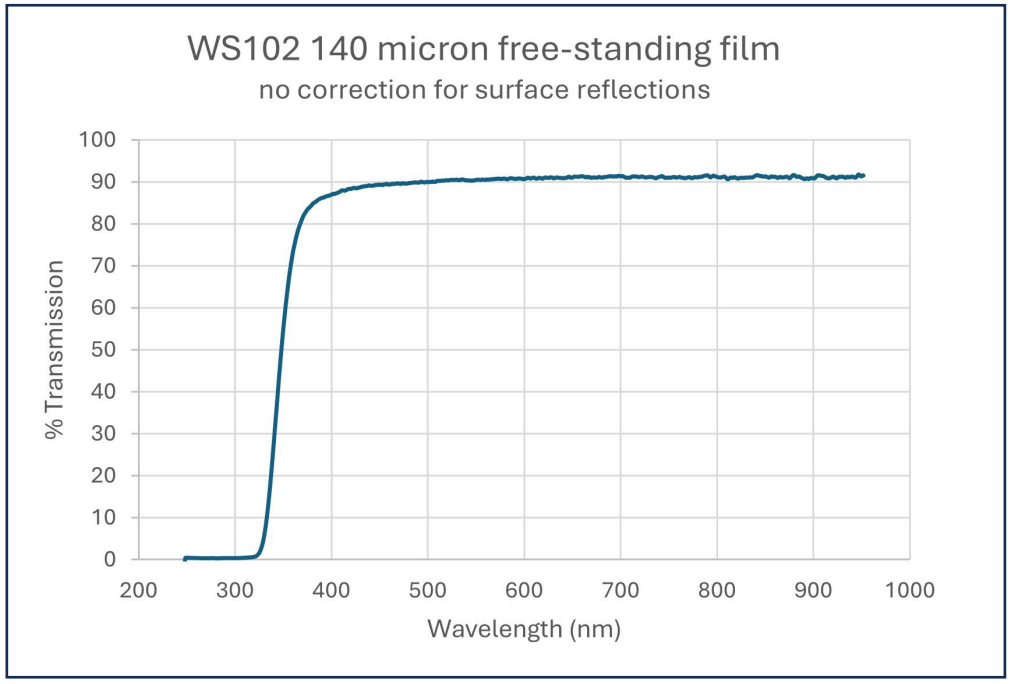
Property	WS-101	WS-102
Viscosity (cps @ 25 °C)	900 to 1,000	650 to 800
LED 365 nm dose (J/cm^2)*	50 - 55	50 - 60
Young's Modulus (GPa)	2.0	1.6
Tg after cure (°C)	116	108
Water contact angle on working stamp (°)	116	117

*In oxygen-free atmosphere or between two substrates; 250 mW/cm^2 from 365 nm LED flood lamp

Transmission Spectra

- UV-vis spectra without correction for surface reflections

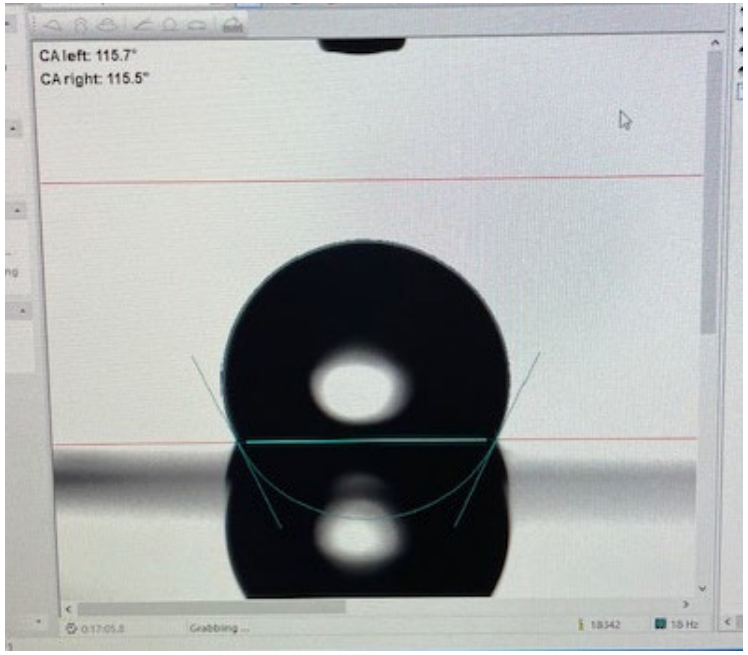




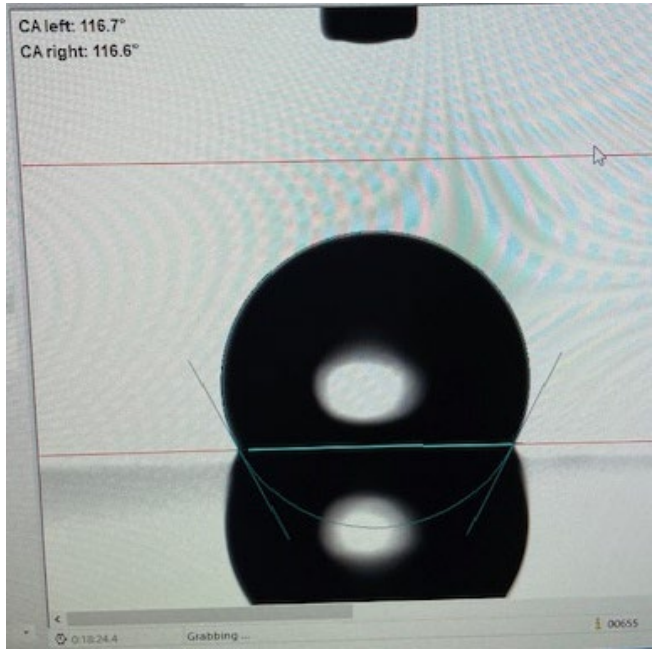
Hydrophobic surfaces

- Contact angles after release from metal plate (dataphysics goniometer)

WS-101



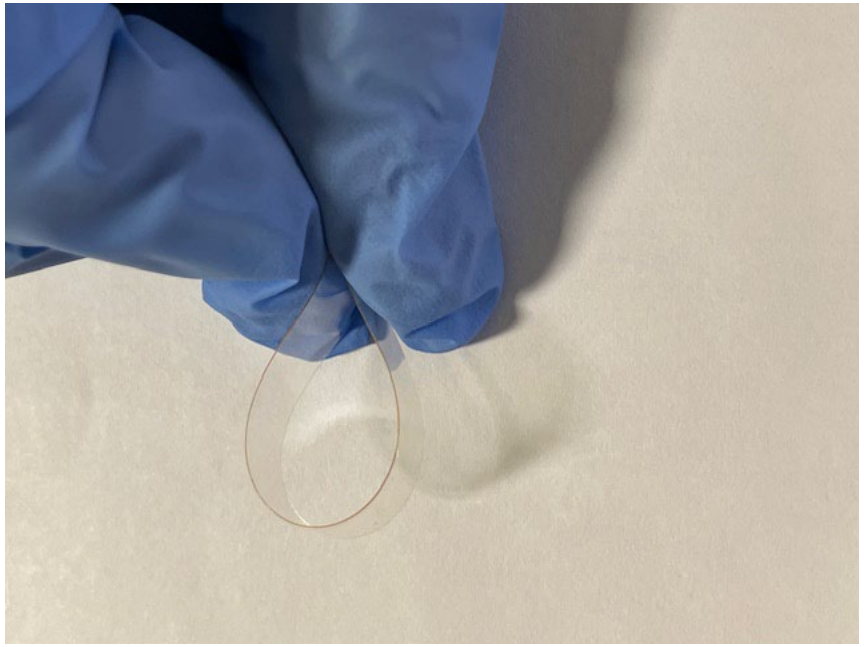
WS-102



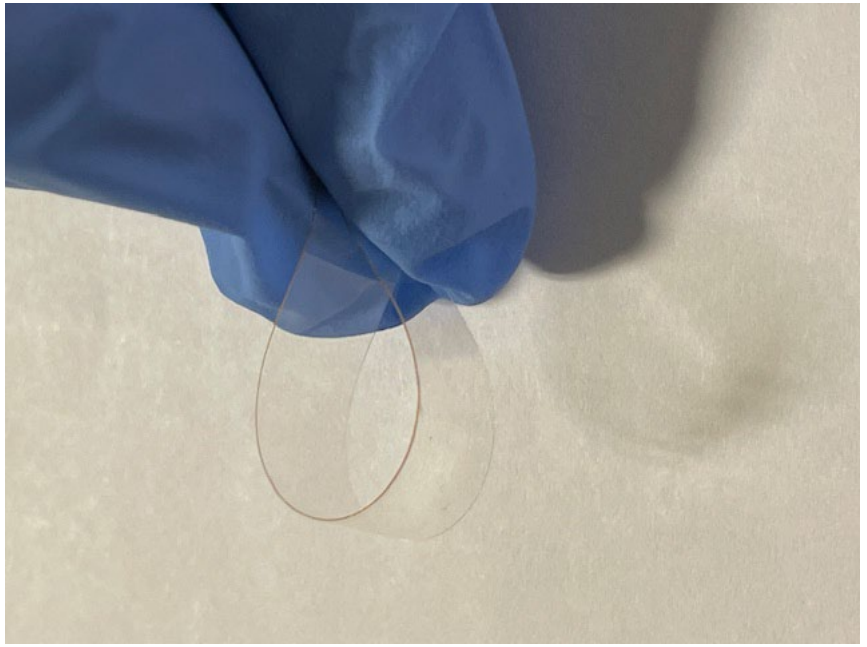
Flexibility

- Cured resins are ca. 150 microns thick

WS-101



WS-102



Summary for WS-101 and WS-102

- PFAS-free: environmentally friendly
- High water contact angles
  - No anti-stick layer on WS required for the imprint process
- New (epoxy) chemistry:
  - eliminates surface grafting of imprint to working stamp
- L2002-C56 imprints can be separated easily from the working stamps