ACW’s PFAS-Free Working Stamp Resins for Micro- and Nano-Imprint Lithography

Advantages of ACWs Working Stamps

1. PFAS-free: Environmentally friendly
2. Anti-stick layer on working stamp is NOT required for the imprint step: reduces process steps
3. Excellent chemical resistance: resists etching by aggressive imprint resins, minimizes height gain for multiple imprints
4. Excellent mechanical and thermal stability

Working Stamps for Nano-Imprints

- “Soft” working stamps on PET backplanes

- Advantage of soft stamp over hard stamp: Low cost
- Advantage of UV versus heat curing
  - Low cost and high replication accuracy
  - Multiple imprints
- Acrylate working stamp resins: FS-2400, FS-2600
- Epoxy working stamp resins: WS-104, WS-107

FS-2400, FS-2600 Acrylate Working Stamps

- FS-2400 has high modulus, FS-2600 has low viscosity

Property	FS-2400	FS-2600
Viscosity (cps @ 25°C)	600 - 700	200 - 300
LED 365 nm dose (J/cm^2) oxygen free or between two substrates	10 - 20 (200 mW/cm^2 x 100 sec)	10 - 20 (200 mW/cm^2 x 100 sec)
Young's Modulus (GPa)	2.5	1.0
Tg (°C)	155	147
Contact Angle of water in air (°)	107	117
% transmission (400 to 1000 nm)	>90	>90

Nano-Imprint Results with FS-2400

ACW FS-2400

Binary Gratings ✓
- EVG UV-A (inorg.)
- EVG UV-OA-R18 (org.)
- mrt mr-NIL213 (org.)
- ACW LuxNIL P285
- ACW LuxNIL Q70

High Aspect Ratio ✓
- EVG UV-A
- ACW LuxNIL P285

Slanted Gratings ✓
- EVG UV-A
- ACW LuxNIL P285

Roller Speed for ACW P285 could be **increased** up to 25% for binary gratings!!!

SmartNIL® POR (test plan): 5%
INCREASED PRODUCTIVITY

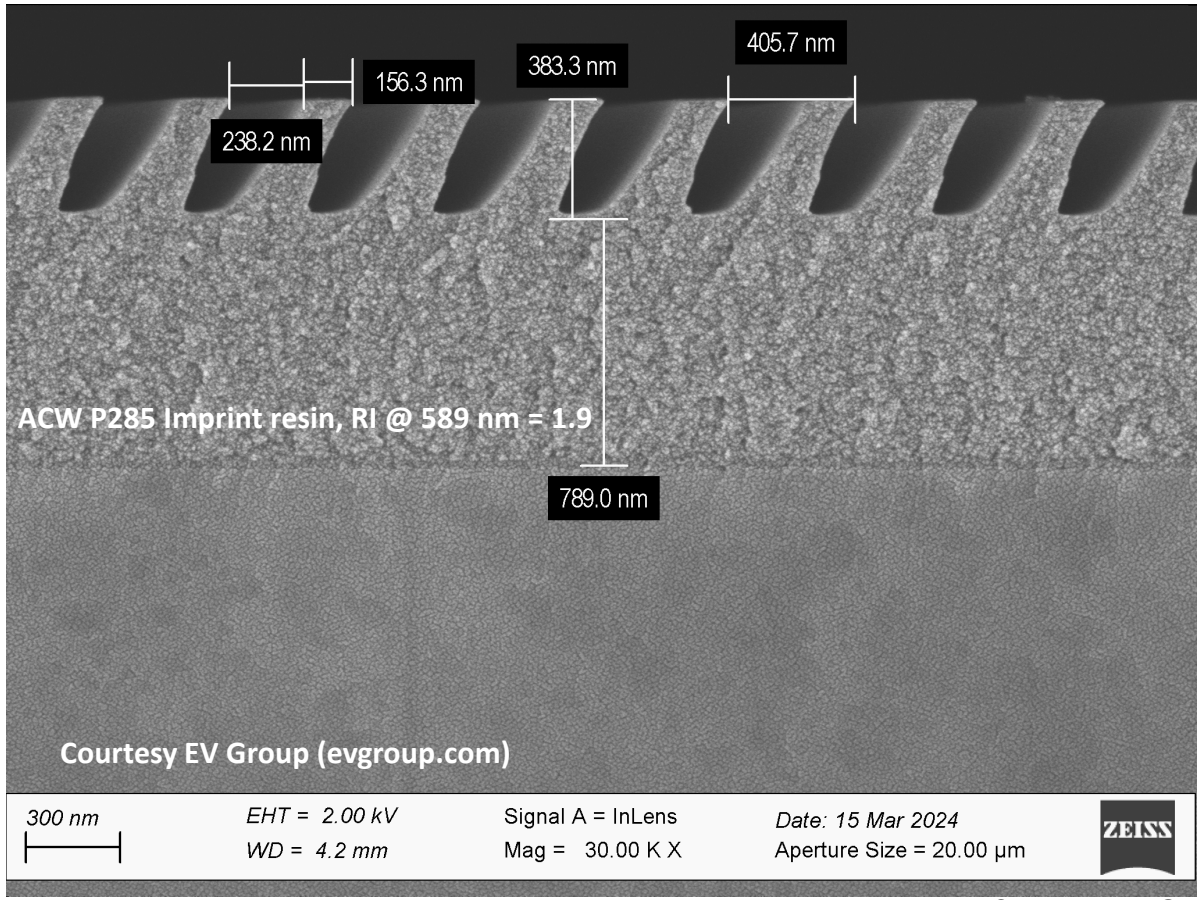
Smooth and easy detachment of imprints even for slanted features

HIGH YIELD

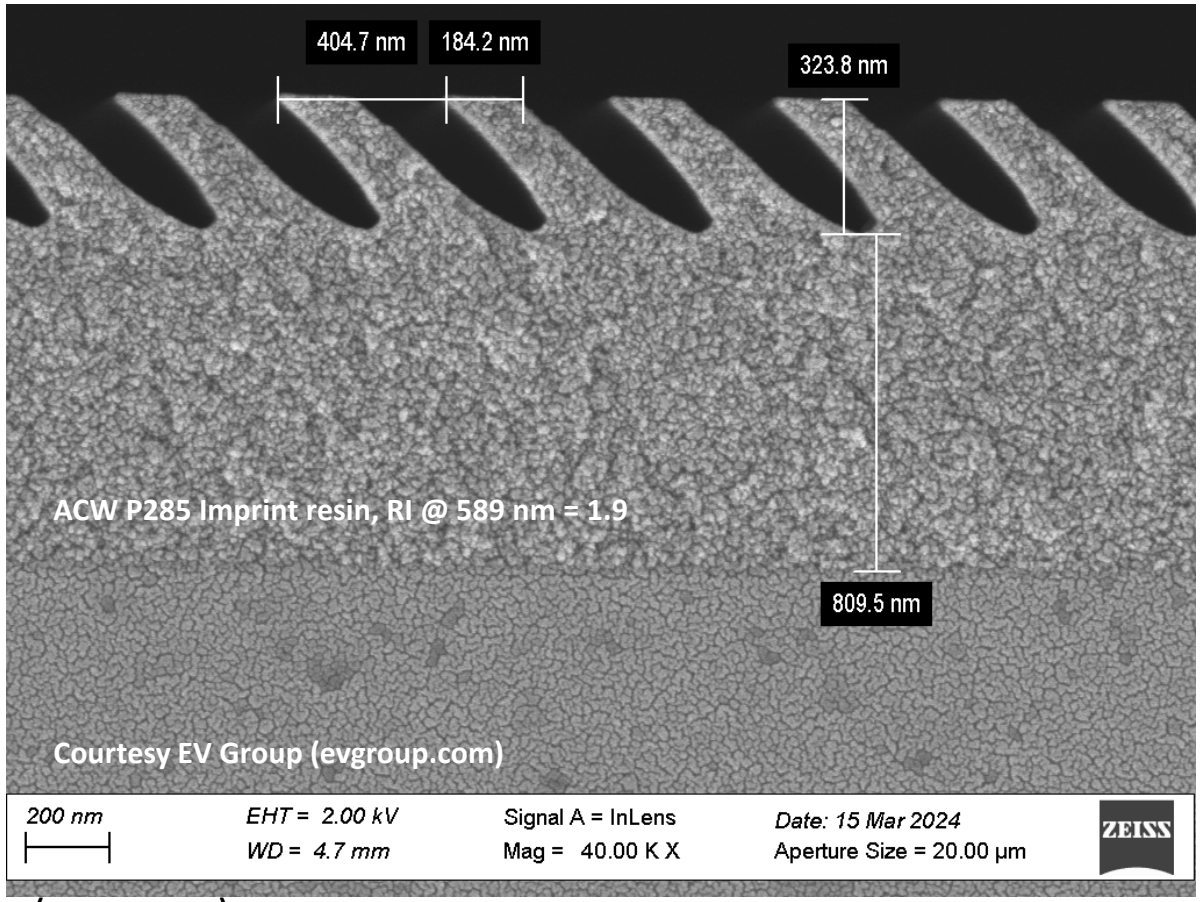
Courtesy EV Group (evgroup.com)

FS-2400 WS Used for Slanted Features

30° Angle



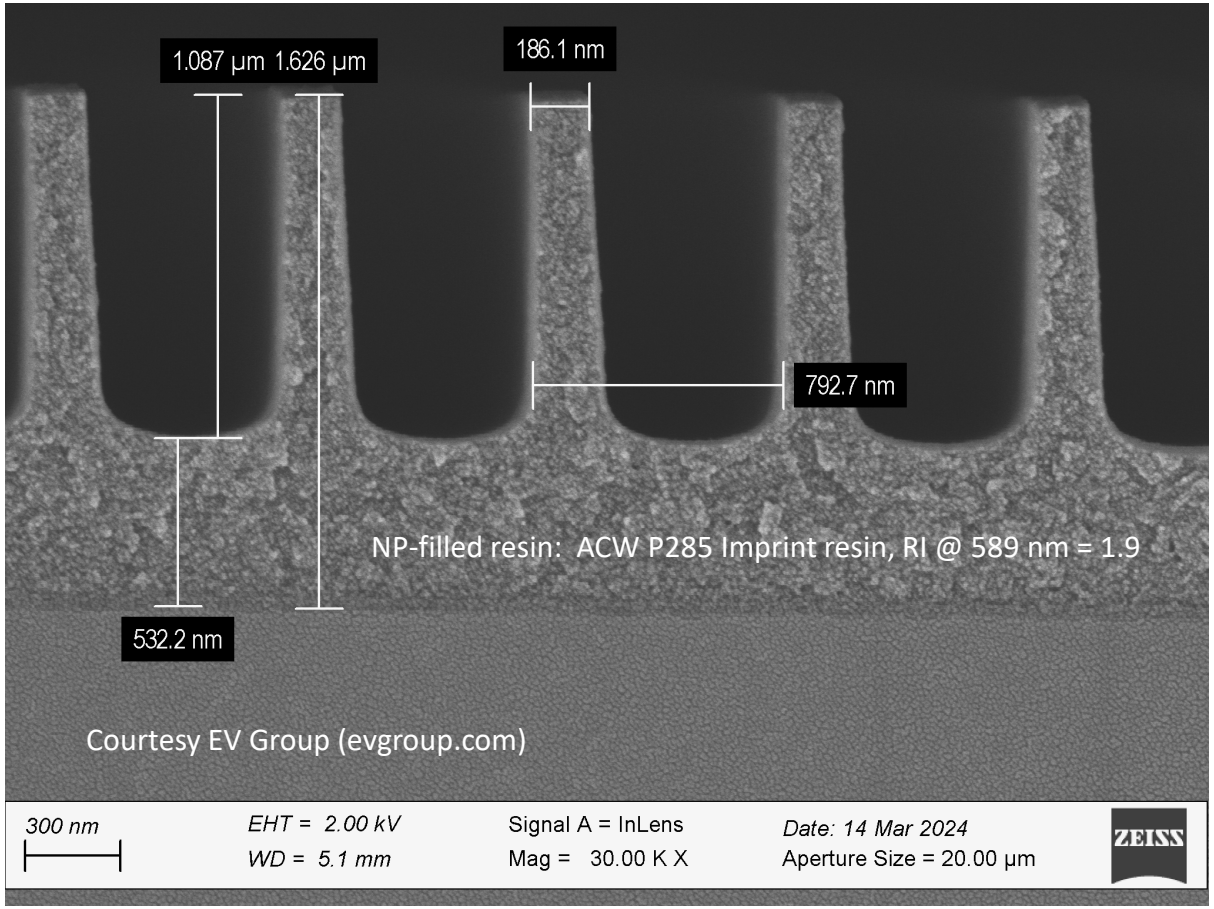
45° Angle

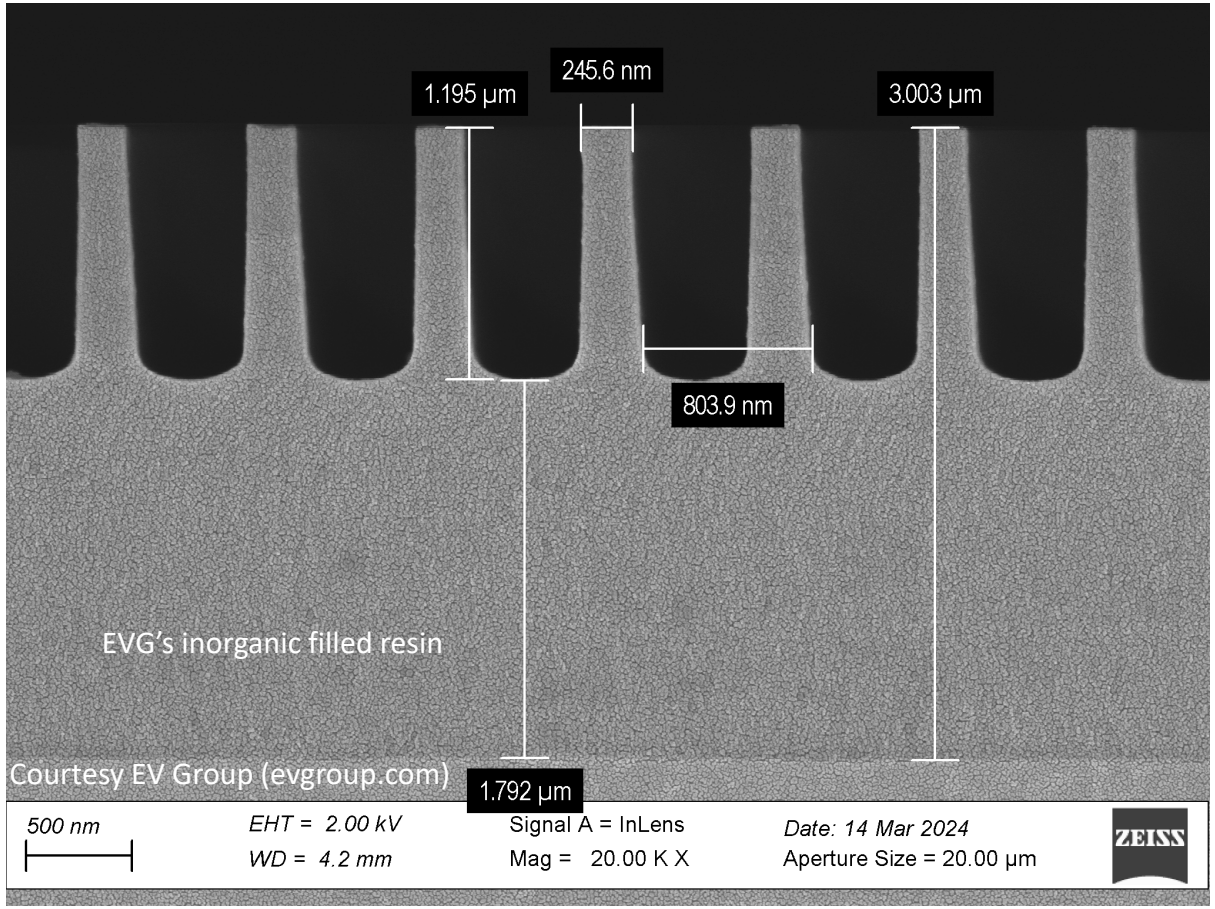


Courtesy EV Group (evgroup.com)

Residual layer thickness was not optimized in these studies

FS-2400 WS Used for High Aspect Ratios

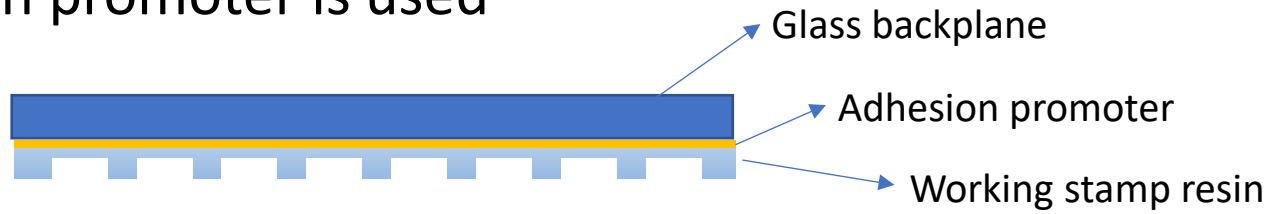




Courtesy EV Group (evgroup.com)

Working Stamps for Micro-Imprints

- "Hard" working stamps on glass backplanes
  - An adhesion promoter is used



- The working stamps are cured by UV irradiation
  - Advantages: low costs and high replication accuracy
- WS-104 and WS-107
- Epoxy resins: high chemical resistance, easy imprint detachment

WS-104, WS-107 Epoxy Working Stamps

- WS-104 and WS-107, excellent flexibility and adhesion

Property	WS-104	WS-107
Viscosity (cps @ 25°C)	300 - 400	350 - 450
LED 365 nm dose (J/cm^2) oxygen free or between two substrates	38 - 50 (250 mW/cm^2 x 150 to 200 sec)	38 - 50 (250 mW/cm^2 x 150 to 200 sec)
Young's Modulus (GPa)	1	1
Tg (°C)	78	78
Contact Angle of water in air (°)	115	115
% transmission (400 to 1000 nm)	>90	>90

ACW Working Stamp Resins

- PFAS-free: environmentally friendly
- High water contact angles: no anti-stick layer needed for the imprint step
- Excellent chemical, mechanical and thermal stability
  - Multiple imprints with minimal height gain
- ACW working stamp resins are commercially available
- Contact ACW for details at *info@addisoncw.com*