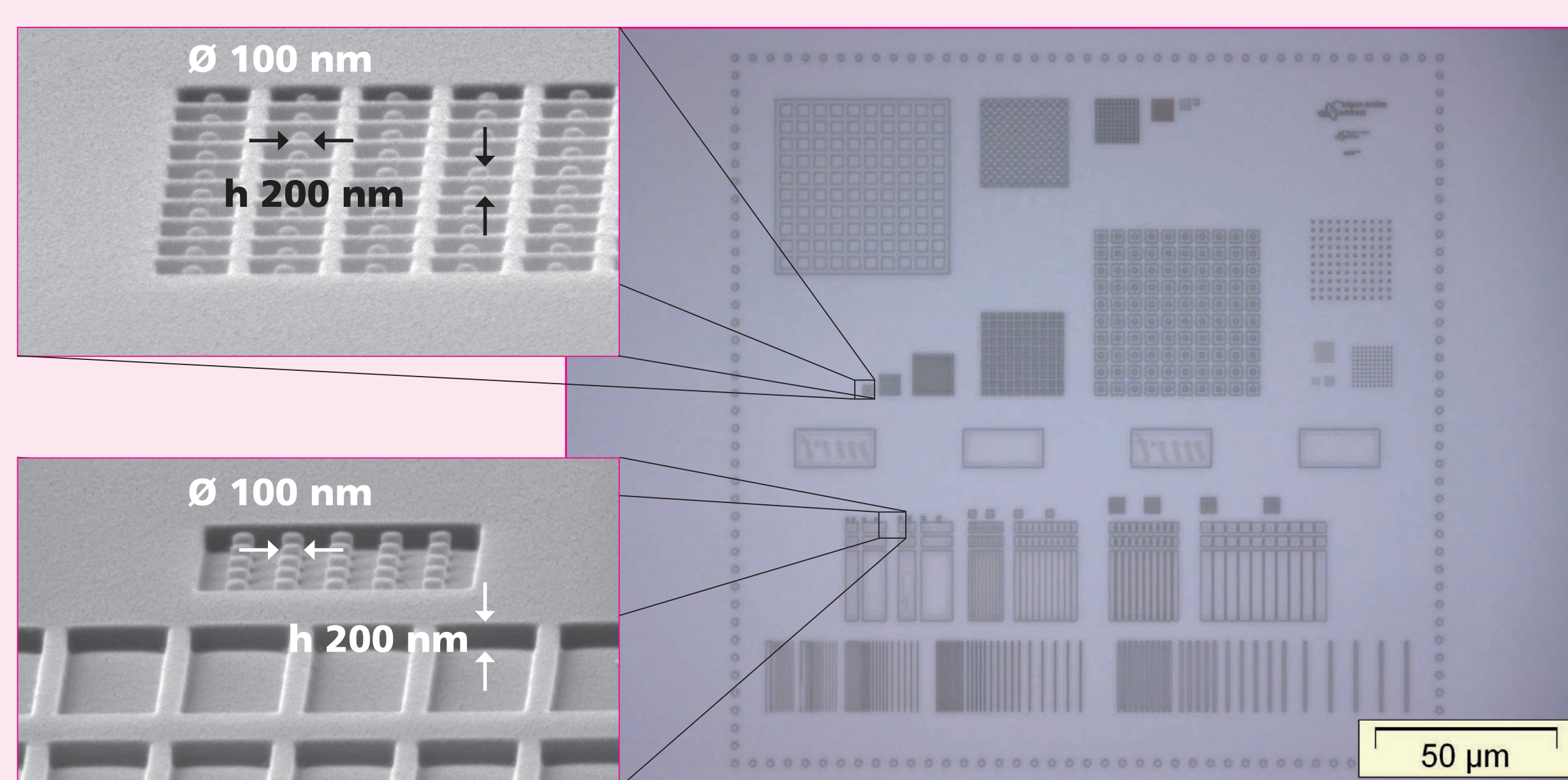
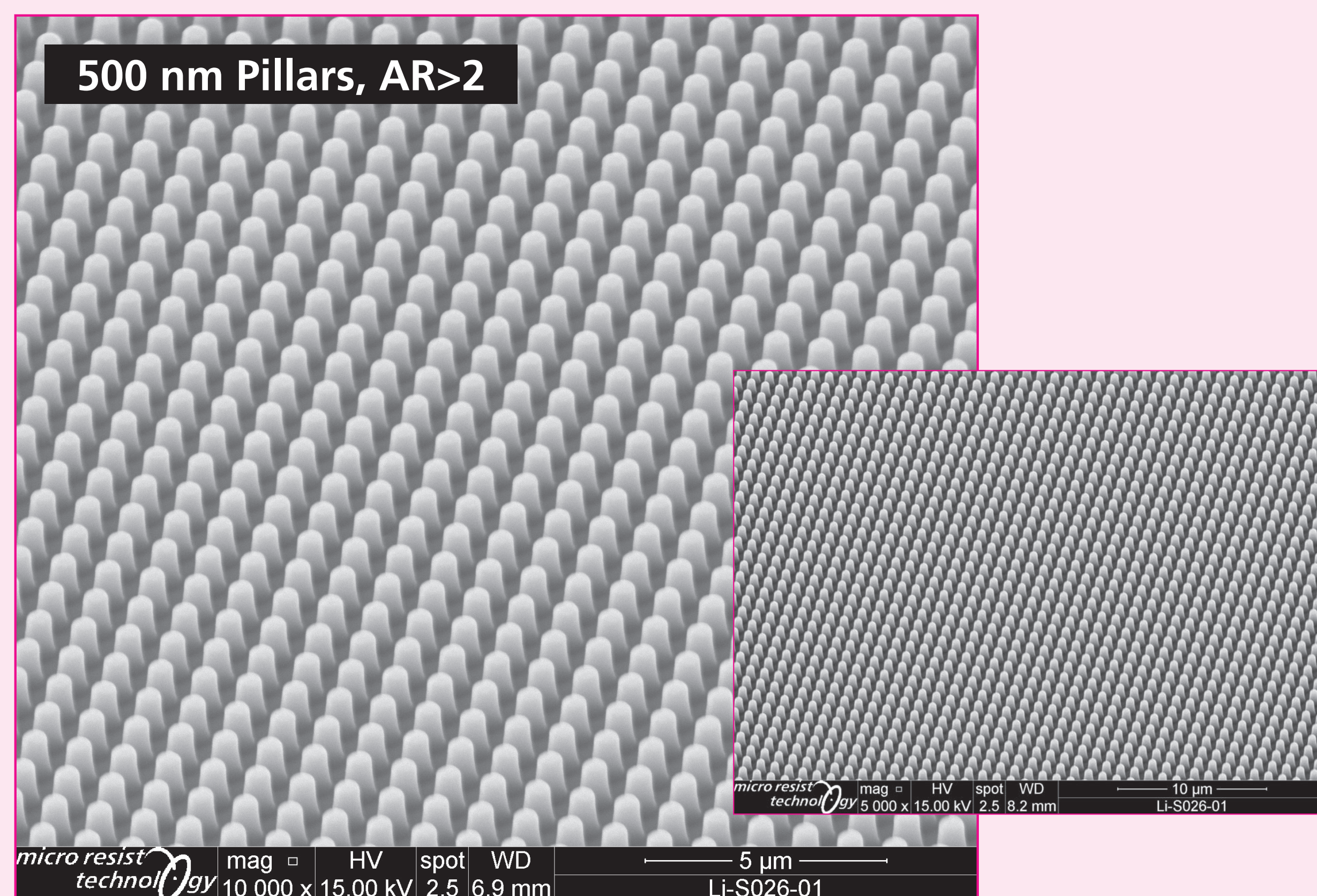


mr-NIL210 - A New PDMS-Compatible Photo-Curable Nanoimprint Resist

mr-NIL210 is a purely organic, photo-curable NIL resist featuring excellent curing and nanoimprint performance in combination with PDMS soft stamp materials. The most important industrial key parameters like its optimized PDMS compatibility (i.e. extended stamp longevity), increased dry etching resistance in demanding plasma processes (i.e. manufacturing of patterned sapphire substrates PSS), and excellent reproducibility enabling high volume production are unprecedentedly addressed.



Example 1 Imprint of miscellaneous nano- and micrometer test structures into **mr-NIL210** using a UV-PDMS¹ stamp.



Example 2 Large area imprint (50 x 50 mm) of sub micron pillars (500 nm in diameter, 1.12 µm in height) into **mr-NIL210** using a UV-PDMS¹ stamp.

Imprint Parameters

Photo-NIL resist: **mr-NIL210**

Stamp material: UV-PDMS X-34-4184-A/B¹

Substrate: 2 inch Si wafer (w/o Primer)

Imprint: 1000 mJ cm⁻² Hg bulb (365 nm) radiation, no applied pressure

Initial layer thickness: 1.8 µm (w/o optimization of the residual layer)

Resolution: smallest resolution presented herein are 100 nm pillars

Etching Performance in Sapphire

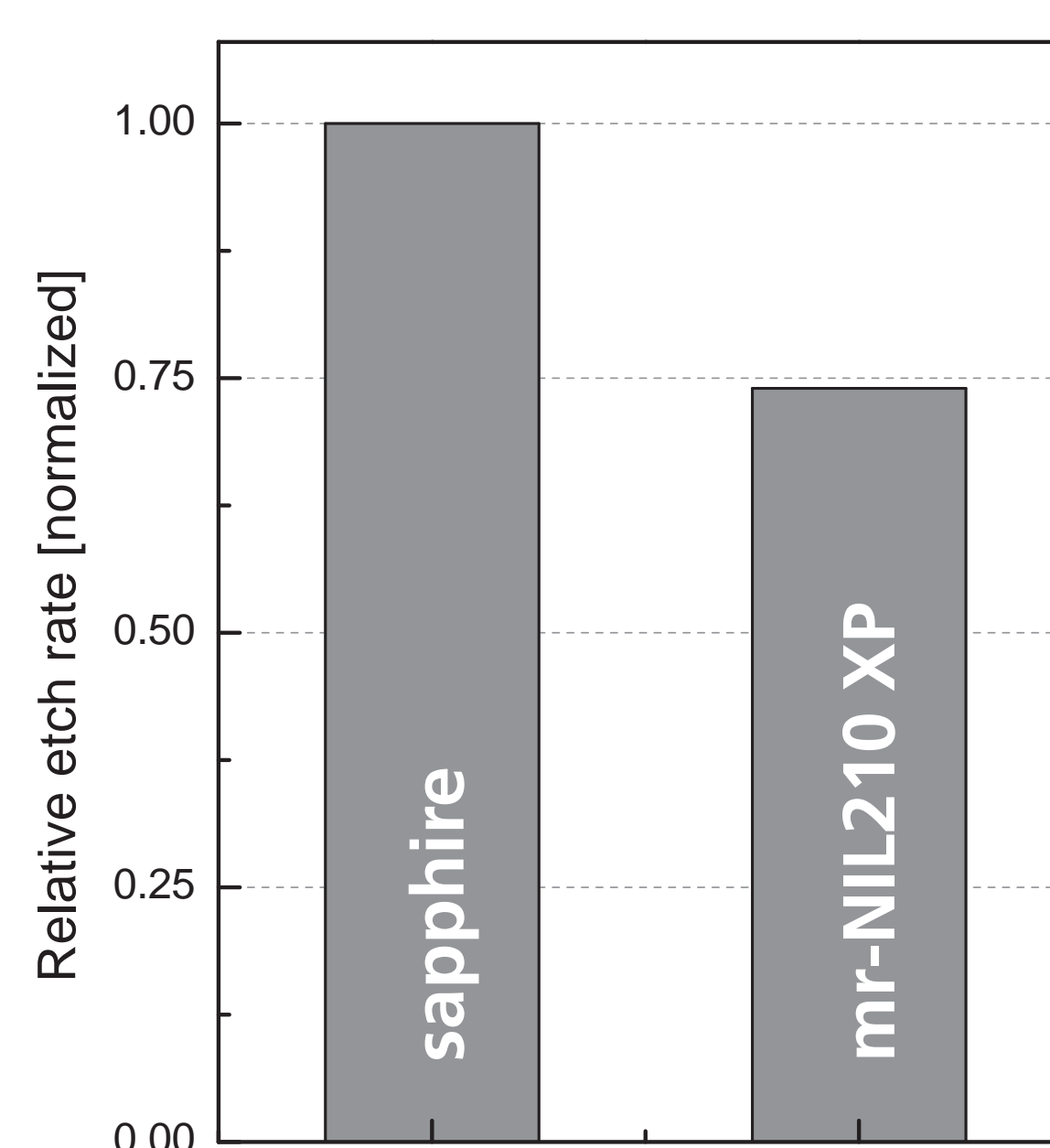


Figure
 Comparison of the dry etching rate between sapphire and **mr-NIL210**.

Etch rate of **mr-NIL210** is 1.35 fold lower compared to sapphire (versus conventional photoresist SPR955 0.93).

mr-NIL210 is especially developed as an etch mask for sapphire etching.

Etch tool: ICP-RIE Plasma Etcher - SI 500 from Sentech, Germany

Etching parameters: chamber pressure 0.5 Pa, ICP 800 W, RF 300 W, bias voltage -240V, Cl₂/BCl₃ plasma, He-backside cooling (25 °C), 2-inch sapphire wafer

Film characteristics

- Brilliant film forming characteristics, film stability, film thickness uniformity, and storage stability over several hours
- Film thickness freely adjustable from sub 100 nm range up to several microns

Photo-Nanoimprinting

- Excellent imprint and photo-curing performance under ambient conditions as well as in the presence of air
- Outstanding compatibility to PDMS soft NIL stamps
- Suitable for the fabrication of micro- and nanoimprinted structures
- Enables high volume production by extended PDMS stamp longevity
- Photo-curing enabled also for LED (up to 405 nm) beside Hg bulb

Dry etching characteristics and stripping

- Excellent etching characteristics for many demanding substrates like sapphire, silica, etc.
- Facile removal of residual cured resist material by wet-chemical stripping or by oxygen plasma stripping

¹ UV-PDMS was provided by Shin-Etsu Silicones and UV-PDMS X-34-4184 A/B was used for the fabrication of all mentioned NIL stamp copies.

The work presented herein was achieved in close cooperation with Shin-Etsu Silicones, Japan.



The etching performance was determined in cooperation with Sentech Instruments GmbH, Germany and the Ferdinand-Braun Institut, Germany.