AMONIL & AMOPRIME - low viscosity imprint resist and adhesion promoter

Description:
UV Nanoimprint is a mechanical molding technique. A template made from quartz or a flexible elastomer with a 3D relief is brought into intimate contact with a UV-curable resist spin-coated on top of a substrate. Applying low imprint pressure at room temperature features are filled within seconds due to the low viscosity of the imprint resist. The resist is hardened via UV-light through the backside of the template. Finally substrate and template are separated. The replicated resist relief can further be transferred into the substrate via RIE-process or used as functional element.

Application:
- UV-based Nanoimprint Lithography

Specification:
- Base material viscosity: 50mPa s
- Photo initiator designed for UV-curing at 320 nm wavelength
- Capability for step&repeat cycles > 1000 imprints demonstrated
- Exposure dose: $2J/cm^2$ using quartz mold

Description:
- Organic-inorganic composite material

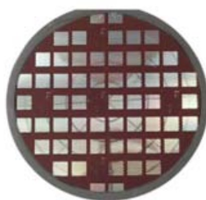
Availability:
- AMONIL available in three versions with film thicknesses from 100 nm to 800 nm
- AMOPRIME available as adhesion promoter

Features:
- Applied by standard spin-coating process
- Usable with quartz, PDMS and PFPE molds
- Good adhesion to silicon substrates
- Average adhesion to SiO_2, Ti, Au, PE
- Adhesion is vastly improved using AMOPRIME for substrate preparation
- Use of AMOPRIME allows imprinting on GaAs, GaN, InP, Al_2O_3

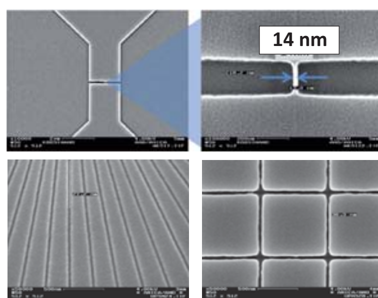
Imprint Resist	Thickness @3000rpm	Quantity 100ml	Quantity 200ml	Quantity 500ml	Quantity 1000ml
AMONIL MMS10	100nm	X	X	X	X
AMONIL MMS4	200nm	X	X	X	X
AMONIL MMS1	800nm	X	X	NA	NA
Adhesion Promoter	**Thickness @3000rpm**	**Quantity 100ml**	**Quantity 200ml**	**Quantity 500ml**	**Quantity 1000ml**
AMOPRIME	<10nm	X	X	X	X

Results for imprinting with flexible PDMS molds:

Printing of 4 inch silicon wafers with one imrint step only



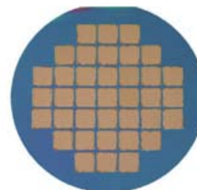
Resist structures



Resist: AMONIL MMS 4

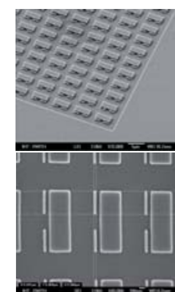
Results for imprinting with quartz molds:

Step and repeat applicability



> 1.000 imprints with quartz molds and AMONIL

Resist structures



Resist: AMONIL MMS 4

Courtesy of IHT, RWTH Aachen University, Germany

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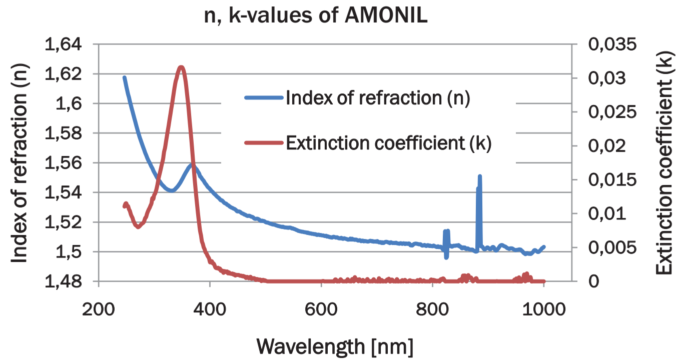
Extinction coefficient k and index of refraction n of liquid AMONIL:

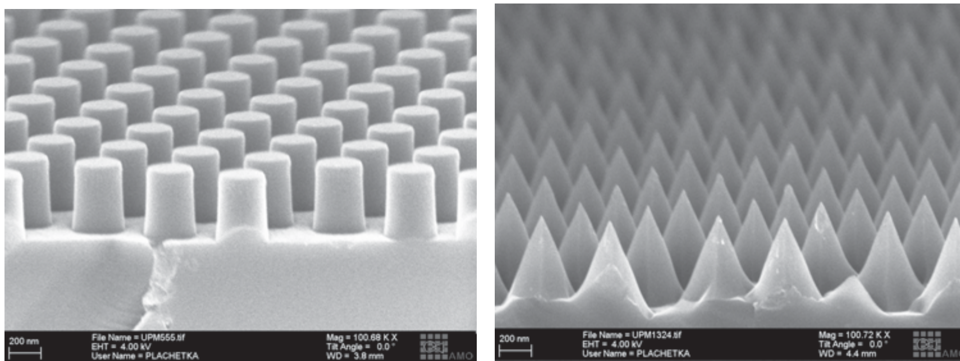


Exemplary etch processes usable for etching with AMONIL resist:

Gas type	Flow rates [sccm]	Etcher	ICP/ECR-power [W]	RF-power [W]	Target material	Target etch rate [nm/min]	AMONIL etch rate [nm/min]
HBr	50	Oxford Plasmalab 100 (ICP)	1000	50-150	Si	40-150	10-150
$SF_6/C_4F_8/He$	7/10/15	Oxford Plasmalab 100 (ICP)	200	20	Si	84	50
CHF_3/Ar	25/75	Oxford Plasmalab 100 (ICP)	0	150	SiO_2	25	32
BCl_3	50	Roth&Rau (ECR)	500	100	Ti	75	100
$CHF_3/Ar/He$	23/10/2	Roth&Rau (ECR)	1000	100	SiO_2	50	50

Use of oxygen plasma or oxygen content in the etch plasma leads to roughening of pattern surfaces.

Exampling etch results in silicon using different process parameters:



Stripping of resist:

The stripping of cured resist depends on the used processs conditions; especially if etching has been performed.

- Partially cured resist: complete removal using acetone
- Cured resist: TMAH, $H_2O_2/H_2O/H_2SO_4$: (8/1/1), piranha
  (*J. Viheriälä, J. Tommila, M. Viljanen, T. Alasaarela, T. Niemi; Protective coating for nanoimprint template using atomic layer deposition; to be published in MNE-proceedings 2010/11*)

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