

(Room-temperature nanoimprint lithography)

1.

가 . 가 21C  
 가 가 . Chou

2.

가  
 가 [1].

(free volume)

(RT-NIL) / [2]. RT-NIL  
 가 가

가 .  
 , RT-NIL  
 가

[3].

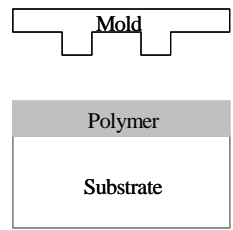
$$f_v = (v_s - v_{vs}) / v_s \tag{1}$$

$v_s$   $v_{vs}$   $f_v$   
 0.32~0.375 . 가

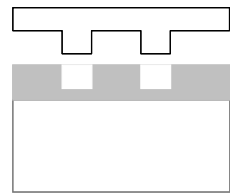
[3].

$$f_m = (v_{so} - v_{cso}) / v_{so} \tag{2}$$

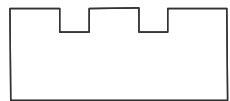
$V_{so}$      $V_{cso}$     0 K  
 $f_m$     0.125    0.14  
 $f_v^{1/3} h \sim f_m^{1/3} h$     (3)  
h    100nm  
가    10    30nm  
가  
가    1GPa  
0.05GPa  
Young    150GPa  
1GPa    [4].    가  
2 2 cm<sup>2</sup>    1μm    Si  
100,000g/mol    (PDI)    1.02~1.05  
가  
RIE    SiO<sub>2</sub>  
6    10  
SiO<sub>2</sub>/Si    /  
trichloroethylene    methanol,    isopropylalcohol    5  
0.5%    10%  
150    200  
50nm    550nm  
Si/SiO<sub>2</sub>/PS    5    20    30  
150MPa  
가  
(SEM)    가  
/



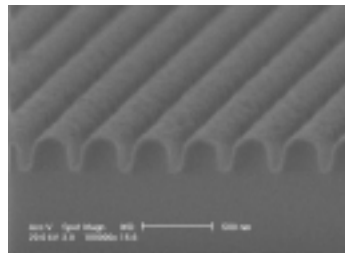
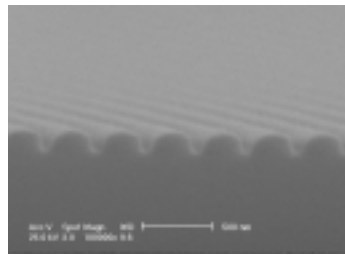
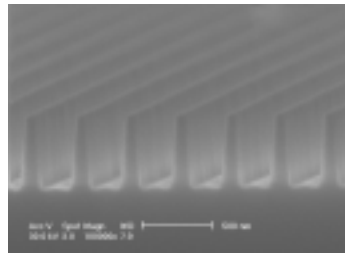
Pressing



Pattern transfer  
(2-step reactive ion etching)



(a)



(b)

1. (a) RT-NIL (b) (80nm line/270nm space)

가 1

SiO<sub>2</sub> SEM ( )  
가 가 50nm 150nm  
가 500nm

가

가 100nm가

CF<sub>4</sub>

SiO<sub>2</sub>

SiO<sub>2</sub>

SiO<sub>2</sub>/Si

CHF<sub>3</sub>/CF

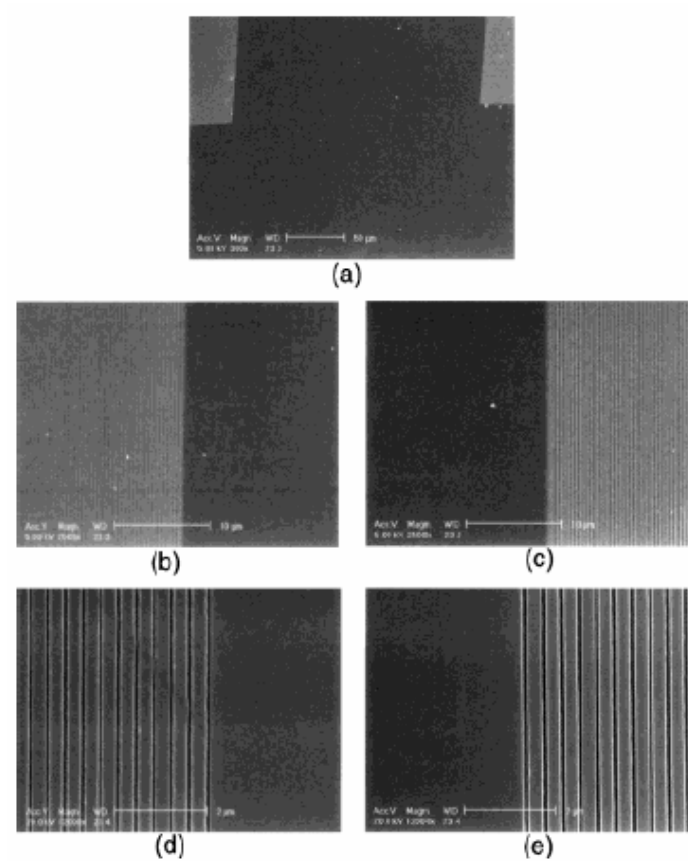
SEM

SiO<sub>2</sub>

RT-NIL

/

가 2



2. Step and repeat

(a) 80

300

(b, c)

(d, e)

가

3.

- [1] S. Y. Chou, P. R. Krauss, and P. J. Renstrom, *Science*, 272, 85 (1996).
- [2] D. Y. Khang, H. Yoon, and H. H. Lee, *Adv. Mater.*, 13, 749 (2001).
- [3] H. -G. Elias, *Macromolecules*, Vol. 1, Plenum Press, New York (1984).
- [4] M. Ohring, *The Materials Science of Thin Films*, Academic Press Inc., New York (1991).