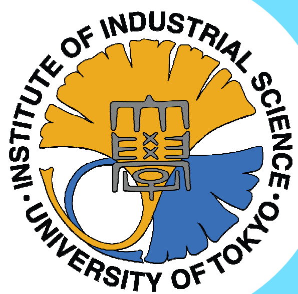


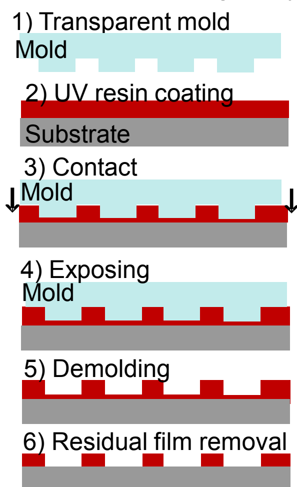
Collective transfer of nanopatterns using flexible conductive mold

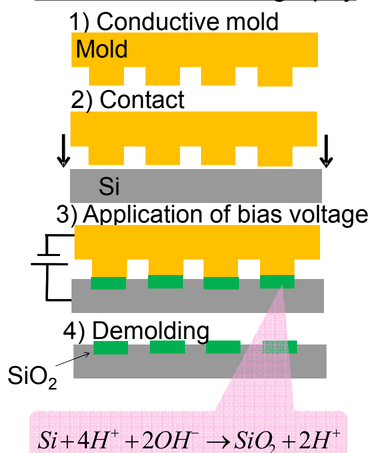
Y.F. Li, K.H. Chen, H. Fujita and H. Toshiyoshi

A new lithography method (nanoelectrode lithography) using a flexible conductive mold (FCM) to collectively transfer nano-patterns in large area via an electrochemical reaction is demonstrated. Compared to conventional nanoimprint methods, this method is not only able to reduce the number of process steps thus fabrication cost, but also can improve the throughput and the accuracy due to resistless process. Oxide nano-patterns with a half pitch of 200 nm corresponding to the conductive pattern of FCM were collectively transferred on a Si substrate in millimeter-scale area.

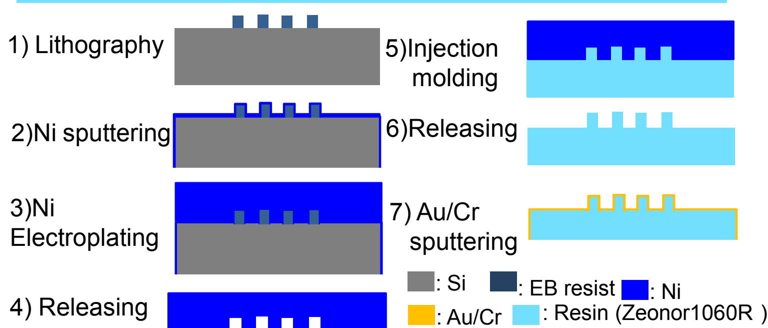
Introduction

◆ Features compared to nanoimprint
- resistless process
- reduced process steps thus fabrication cost
- improved throughput and accuracy





Fabrication

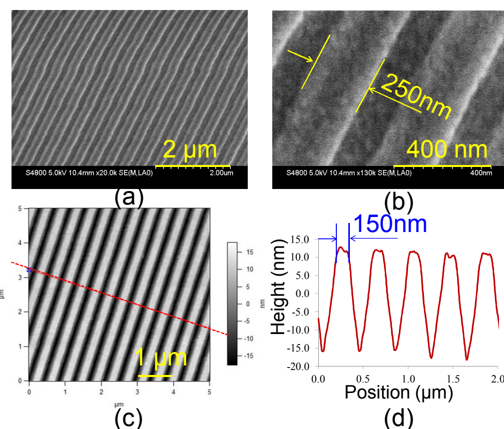


◆Fabricated FCM

> Resin Mold
- Half pitch: 200 nm
- Height: 50 nm

>Metal depo.
- Au/Cr thickness: 25 nm

>FCM
- Half pitch: 200nm
- Line width(top): 150 nm

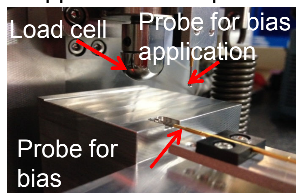


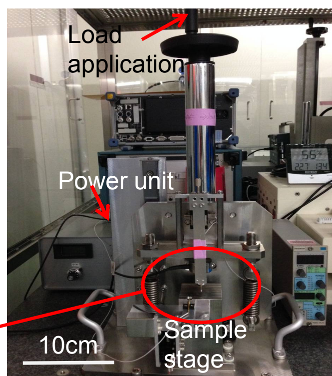
(a) (b) (c) (d)

Experimental setup & results

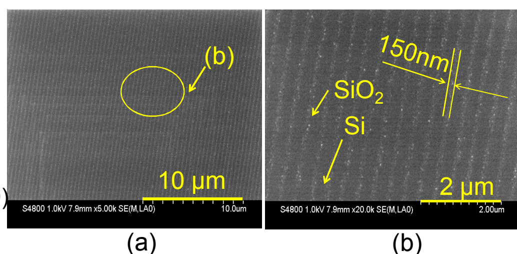
◆Press machine :
- Mold and substrate size: ~ tens of mm²
- Force: 0 ~ 500N

◆Power unit :
- Bias voltage: 0 ~ 40 V
- Applied time: 10 μs ~ 1s



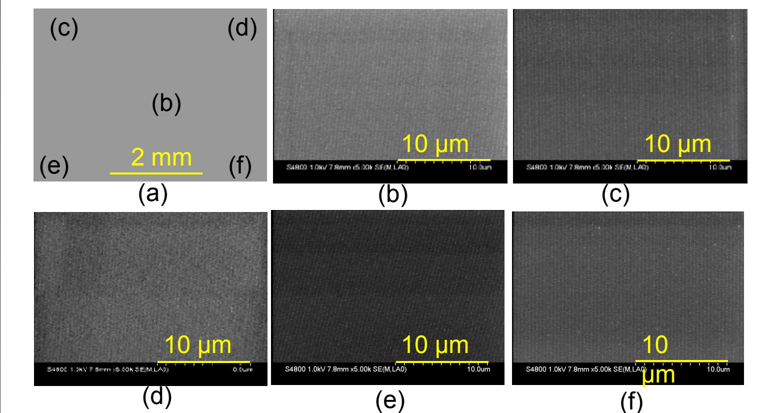


◆Conditions
- Bias voltage : 17 V (0.5Hz, duty:50%)
- Time: 10 s
- Force : 5N
- Humidity : 54%(24.3℃
- Si substrate: p-type (100)
- Resistivity: 5-10 Ω·cm



(a) (b)

Oxide patterns with a line width of about 150 nm and a space of about 250 nm were transferred on silicon.



(a) (b) (c) (d) (e) (f)

Oxide patterns with a half pitch of 200nm were uniformly transferred on silicon substrate in an area of about 5×5 mm².

Future work

We are currently improving the FCM and the setup for uniform transfer of high-accuracy, large-scale pattern.

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