

課題番号 : F-15-UT-0117  
 利用形態 : 共同研究  
 利用課題名 (日本語) : 側壁電極による陽極酸化を用いた一括ナノリソグラフィー  
 Program Title (English) : Collective nano lithography using anodic oxidation by side-wall electrodes  
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### 1. 概要 (Summary)

Toward high-throughput lithography we have fabricated thin-film edge electrodes (TEEs) to collectively transfer nanopatterns by generating oxide on the substrate surface via anodic oxidation. Nanometer-thick TEEs are formed on the sidewall of insulating structures on a stamp. ECR-based oxide patterns have the same width and shape as the TEEs because ECR is induced only between the conductor and the substrate.

### 2. 実験 (Experimental)

#### 【利用した主な装置】

高速大面積電子線描画装置 (ADVANTEST F5112+VD01)

#### 【実験方法】

The principle is shown in Fig.1. After setting the stamp in contact with a Si substrate, negative bias voltage was applied to the TEEs to induce electrochemical reaction for generating oxide pattern corresponding to edge electrodes.

Fig. 2 shows the fabricated stamp. The silicon structure is 5 micrometers wide and 2.8 micrometers high. The thickness of the Cr/Au edge electrode is 30 nm.

### 3. 結果と考察 (Results and Discussion)

Fig. 3 shows the transferred oxide line with 20 N contacting force and pulsed bias voltage of 10 V applied for 15 seconds between the electrodes and the substrate in air with a humidity of 40 % and a temperature of 22.3 °C. Oxide nanopatterns with the minimum width of 25 nm were collectively transferred over a millimeter-scale area.

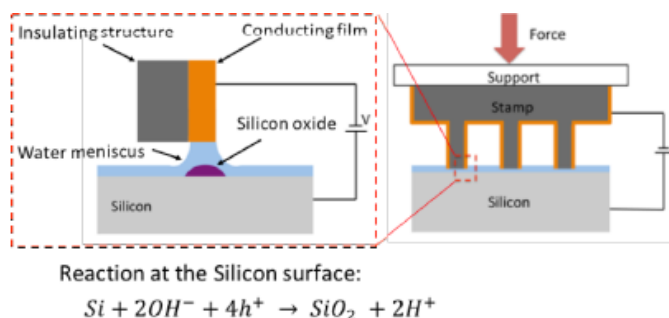


Fig. 1 Principle of lithography using edge electrodes.

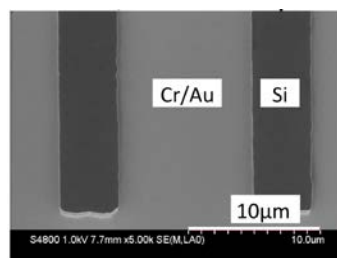


Fig. 2 SEM of a silicon stamp with edge electrodes.

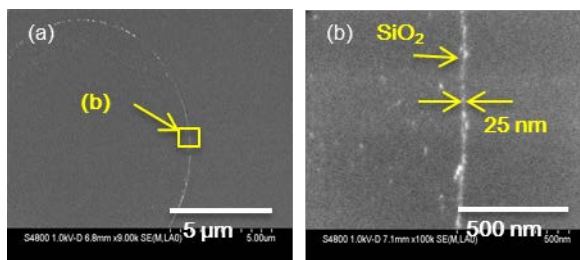


Fig. 3 (a) SEM images of transferred SiO<sub>2</sub> pattern, (b) its expanded view.

### 4. その他・特記事項 (Others)

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### 5. 論文・学会発表 (Publication/Presentation)

[1] K. Chen, H. Toshiyoshi, H. Fujita, Yongfang Li, “Nanopattern Collective Transcription by Thin-Film Edge Electrode Lithography” 電気学会 E 部門センサシンポジウム、新潟、2015年10月28～30日

### 6. 関連特許 (Patent) 出願 1件