課題番号	:F-14-NM-0120
利用形態	:技術代行
利用課題名（日本語）	:ディープ反応性イオンエッチング (DRIE) を用いたシリコンテーパ側壁エッチング
Program Title (English)	:Etching tapered sidewalls in silicon using deep reactive ion etching (DRIE)
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1. 概要（Summary）

Deep reactive-ion etching (DRIE) is a highly anisotropic etch process used to create deep penetration, steep-sided holes and trenches in wafers/substrates, typically with high aspect ratios. This etching method is time-multiplexed etching, which alternates repeatedly between two modes: etching and deposition to achieve nearly vertical structures. In this work, DRIE process using MUC-21 ARE-SRE (Sumitomo Precision Products Co., Ltd.) was employed for etching tapered sidewalls in silicon.

2. 実験（Experimental）

Photoresist with thickness of 10 µm was patterned to create 50-µm-width structure on 3 inch Si wafers for etching process (Fig. 1). Etching conditions, i.e., etching gas flow, etching pressure, etching/passivation ratio, etching power, etc., were adjusted to create different slope angles. The etched samples were cleaved and cross sections were observed to calculate to the slope angle, through the depth D and undercut width W.

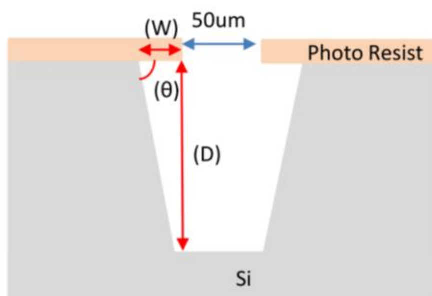

Fig. 1: Sample preparation and taper angle calculation.

3. 結果と考察（Results and Discussion）

By modifying the etching conditions, taper angle could be controlled (Fig. 2). The $O_2/(SF_6+O_2)$ ratio is found to be the most important parameter for the sidewall tapering. Tapered sidewalls would be used in microfabrication processes such as metal coating of 3D-structures (e.g. for electrical connections or vias), mold tool fabrication or as a tool to compensate for reentrant etching.

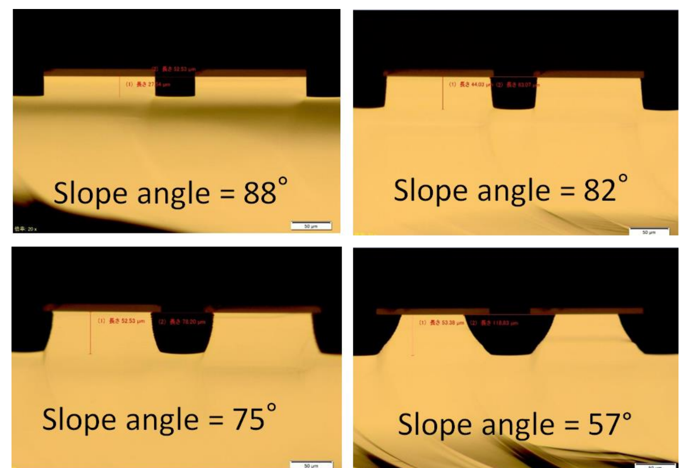

Fig.2: SEM cross-section images of vias with different slope angle. Different angles obtained by modifying etching conditions.

4. その他・特記事項（Others）

なし。

5. 論文・学会発表（Publication/Presentation）

なし。

6. 関連特許（Patent）

なし。