課題番号　:F-20-TU-0038
利用形態　:機器利用
利用課題名（日本語）　:安全とセキュリティのための IoT
Program Title (English)　:IoT for Safety and Security
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Energy harvesting, Film deposition, Sputtering, Glass etching, Ion source

1. 概要（Summary）

For developing MEMS devices towards to "*Internet of Things (IoTs) for safety and Security*", it is crucial to establish cost-effectively batch manufacturing process. We partially use the facility at the Center for Integrated Nano Technology Support (CINTS, Tohoku University) to conduct our experiments.

2. 実験（Experimental）

【利用した主な装置】

We mainly used the following research tools:

(i) サンドブラスト：Sandblaster: Shinto Kogyo MB-1-ML; F-TU-043;

(ii) 芝浦スパッタ装置, 自動搬送芝浦スパッタ装置：Metal sputtering systems (Shibaura Mechatronics CFS-4 ESII, F-TU-036; Shibaura Mechatronics i-Miller CFS-4EP-LL, F-TU-075);

(iii) DeepRIE 装置#1：Si-DRIE systems (MUC-21-ASE-SRE)

【実験方法】

Experimental method: Our 500-µm glass spacers laminated with a 50 µm photoresist mask, MS7050, were fabricated by the sandblaster with 14-µm-sized Al_2O_3 particles with the scanning rate of 20 mm/s and the nozzle pressure of 0.25 MPa.

For the metallization process, 200 nm Au/Cr films were deposited at Ar pressure of 0.5 Pa and RF power of 300 W.

Si-DRIE was used to etch through 500 µm Si wafer with the etching rate of about 2.3 µm/min.

3. 結果と考察（Results and Discussion）

Fig. 1 shows the images of our typical glass structure before and after sandblaster. Fig. 2 shows a CCD camera microscope at our laboratory to observe the Au/Cr film surface images.

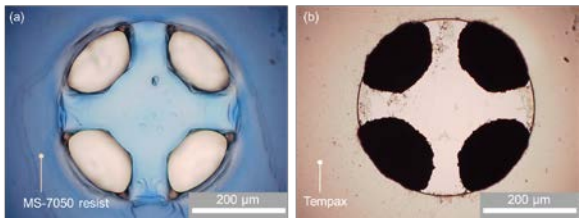

Fig. 1 Images of glass spacer before the sandblaster with the resist mask (a), after sandblaster and removing the resist (b).

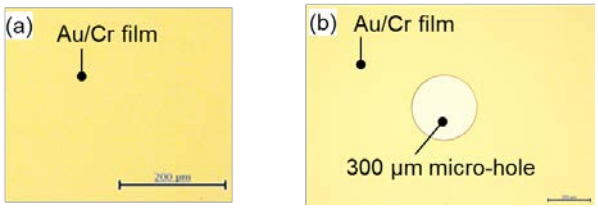

Fig. 2 CCD microscopic images of the typical Au/Cr as-deposited surface (a), after forming micro-hole (b).

4. その他・特記事項（Others）

なし。

5. 論文・学会発表（Publication/Presentation）

Nguyen-Van Chinh, Le-Van Minh, Takahito Ono, Hiroki Kuwano, *The 34th International Conference on Micro Electro Mechanical Systems (MEMS),* Gainesville, FL, USA, 2021, pp.14-17, doi: *10.1109/MEMS51782.2021.9375217.*

6. 関連特許（Patent）

なし。