

課題番号 : F-18-KT-0020
 利用形態 : 機器利用
 利用課題名(日本語) : PECVD DLC を被覆した Si 微小構造体の引張強度特性に対する成膜バイアスの効果
 Program Title(English) : Effect of bias voltage on tensile properties of silicon microstructure coated with PECVD DLC film
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 キーワード/Keyword : MEMS Fabrication, CVD, Lithography

1. 概要(Summary)

DLC (diamond-like carbon) coating can improve the tensile properties of silicon device in our previous research. Now we are investigating the influence of DLC coating on silicon microstructures with different bias voltage and exploring the correlations between coating parameter and improvement in tensile strength.

2. 実験(Experimental)

【利用した主な装置】

- [A3] Laser pattern generator
- [A54] Double-sided mask aligner
- [B8] Reactive ion deep silicone etcher (deep RIE)
- [C22] Nano-indenter

【実験方法】

Tensile specimens were fabricated using SOI wafer. Upper and lower side photolithography were done by stepper and double-side mask aligner while the deep RIE machine was used for silicon trench etching from the both sides (Fig. 1(a)). PECVD (plasma-enhanced CVD) was used for the full-covered DLC coating at the fabricated specimens with different deposition bias. The fracture toughness was measured by nano-indentation method.

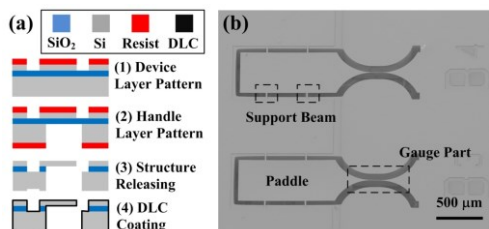


Fig. 1 Sample fabrication.

3. 結果と考察(Results and Discussion)

The SCS microscale structures were conformally coated with DLC film (Fig. 1(b)). The tensile test results showed that the average strength of coated samples was 13.2–29.6% higher than that of the SCS sample. Samples fabricated with a -400 V bias were strongest. The fracture toughness of the DLC film was the dominant factor in the observed tensile strength (Fig. 2).

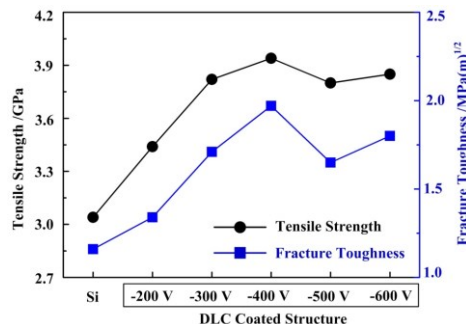


Fig. 2 Average tensile strength and toughness.

4. その他・特記事項(Others)

- ・関連文献
 - (1) W. Zhang et al., Jpn. J. Appl. Phys. 56 (2017) 06GN01.
 - (2) W. Zhang, Y. Hirai, T. Tsuchiya and O. Tabata, MRS 2017 Fall, Boston, America, 2017.
 - (3) W. Zhang, Y. Hirai, T. Tsuchiya and O. Tabata, Appl. Surf. Sci., 443 (2018) 48-54.
- ・他機関利用: 奈良先端科学技術大学(S-17-NR-0042)

5. 論文・学会発表(Publication/Presentation)

なし。

6. 関連特許(Patent) なし。