

※課題番号 : F-12-KT-0023
 ※支援課題名 (日本語) : エキシマレーザーアニールによるシリコンマイクロ構造の表面改質
 ※Program Title (in English) : Surface treatment of silicon microstructures using KrF Excimer Laser
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※概要 (Summary) :

Free standing single crystal silicon samples for fatigue and tensile testing were laser irradiated in order to improve surface roughness and accordingly mechanical performance. Roughness and crystallinity characterization were used after laser treatment. Laser annealing was successful in improving surface roughness while preserving crystallinity of the irradiated structures.

※実験 (Experimental) :

Two types of single crystal silicon samples are prepared for laser treatment. One is for resonating fatigue testing Fig 1. Fan-shaped electrostatic resonator vibrates for in-plane direction. The suspending beam with notch at the center is subjected to cyclic bending stress. This sample is used for fatigue testing. The other type is a cantilever beam for tensile testing as shown in Fig. 2. The large paddle on the free end is used for electrostatic force grip.

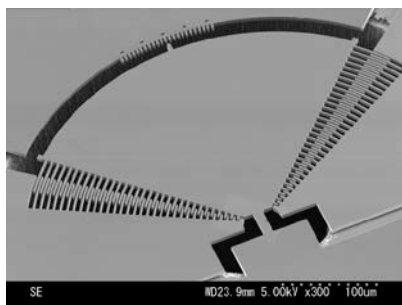


Fig. 1 Fan-shaped resonator for fatigue test.

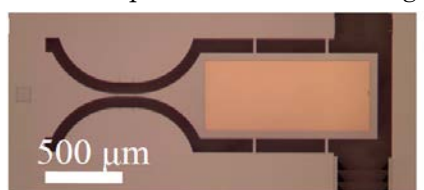


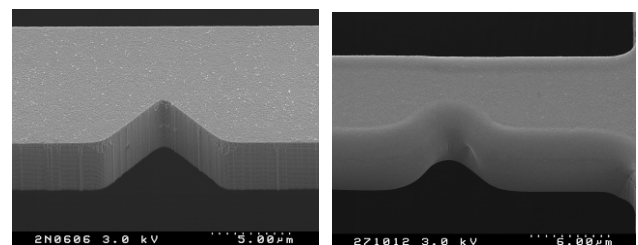
Fig. 2 Specimen for tensile test

Laser treatment and analysis were done in Nanohub, as follows;

- Laser annealing using the B15 system was used on single crystalline silicon structures to have smoother surfaces.
- The Nanowizard AFM (C4) was used to evaluate the resulting surface roughness of annealed surfaces.
- The Hitachi FESEM (C2) was used to take images of the treated surfaces.

※結果と考察 (Results and Discussion) :

Laser annealing was successful in eliminating scallops resulting from fabrication on sidewalls of silicon beams as can be seen from the next figure that shows sidewalls before and after laser treatment. Such results prove to be promising in the later stage of this research when laser treated fatigue test samples and tension test samples would be subjected to mechanical loading to investigate the effect of laser annealing on their performance.



a) As-fabricated b) laser annealed

Fig. 3 notched silicon microbeams for laser treatment

※その他・特記事項 (Others) :

なし