

利用課題番号 : F-13-KT-0040
利用形態 : 技術補助
利用課題名 (日本語) : エキシマレーザアニールによるシリコンマイクロ構造の表面改質
Program Title (English) : Surface treatment of silicon microstructures using KrF Excimer Laser
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1. 概要 (Summary) :

Freestanding microscale single crystal silicon samples were laser annealed to improve surface roughness and accordingly mechanical performance using nanosecond KrF excimer laser. Fatigue and tension test samples were used. Surface roughness improved at certain combinations of laser pulses and energy. Tensile test samples showed an improvement in strength after laser annealing due to an improvement in roughness.

2. 実験 (Experimental) :

- KrF excimer laser annealing using the B15 system was used to improve surface roughness by controlling laser energy and number of pulses
- The Nanowizard AFM (C4) was used to evaluate the resulting surface roughness and topography of annealed surfaces.
- FESEM (C1) was used to take images of the treated surfaces to investigate the effect of laser treatment parameters on surface morphology.

3. 結果と考察 (Results and Discussion) :

Laser annealing improved surface roughness of sidewalls where cracks usually start for fatigue and tensile test samples eliminating scallops resulting from fabrication as shown in the figure 1. Laser treated tensile test samples showed a 20% improvement in strength compared to as fabricated samples. By looking at the cross section of fractured laser treated samples, laser treated surfaces showed significant curvature after treatment as shown in figure 2. Such results prove the significance of surface roughness in determining mechanical

performance. The next step in the current study will be to investigate the effect of laser annealing on fatigue test samples.

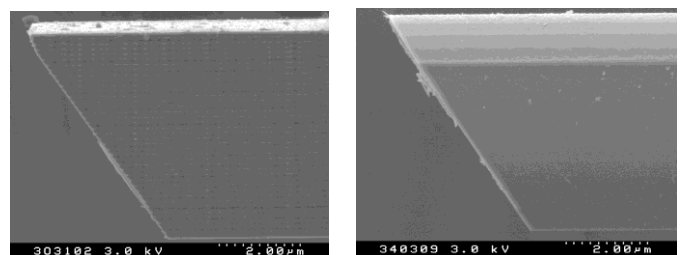


Figure 1: Sidewall of a) as fabricated tensile test sample & b) laser treated tensile test sample after fracture in tensile testing

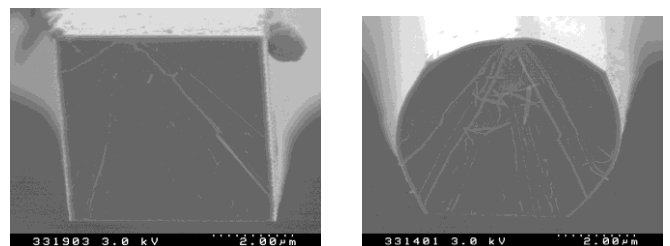


Figure 2: Cross section of a) as fabricated tensile test sample & b) laser treated tensile test sample after fracture in tensile testing

4. その他・特記事項 (Others) :

特になし。

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

M. Elwi Mitwally, et al., Improvement of Tensile Strength of Freestanding Single Crystal Silicon Microstructures using Localized Harsh Laser Treatment The 26th International Microprocesses and Nanotechnology Conference (MNC 2013), Sapporo, Japan, Nov. 5-8.

6. 関連特許 (Patent) :

なし。