課題番号　:F-20-HK-0034
利用形態　:共同研究
利用課題名（日本語）　:
Program Title (English)　: Self-organized nanogratings on the surface of the SF10 glass induced by femtosecond laser pulses
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1. 概要（Summary）

Laser-induced periodic nanogratings are observed on the surface of SF10 glass with tightly focused femtosecond laser beam. Three characterized laser polarization directions which are horizontal, vertical and 45 degree are used to induce the nanogratings on the surface of SF10 glass. The periods change with the incident power and scanning speed. We firstly report that the evolution of periods differs from the previous investigations. Experimental results show that the period of nanogratings on the surface of SF10 glass firstly decreases with the pulse spacing in the relatively smaller pulse spacing, and then increases with the pulse spacing.

2. 実験（Experimental）

【利用した主な装置】

高分解能電界放射型走査型電子顕微鏡（JSM-6700FT, JEOL).

【実験方法】

Femtosecond laser system (800nm, 35fs, 1KHz, 5mJ) was used in the experiments. The laser beam was focused on the surface of SF10 glass which was mounted on a motorized translation stage by a 50× microscope objective. Nanograting structures can be generated by changing the scanning speed and input laser energy. The morphologies of nanogratings were analyzed by SEM.

3. 結果と考察（Results and Discussion）

Figure 1 illustrates the femtosecond laser-induced nanogratings on the surface of SF10 glass with various scanning speed from 5μm/s to 100μm/s. The incident power is 12 mW. The scanning speed at 5μm/s corresponds to pulse spacing 5nm for repetition frequency 1 KHz. The experimental SEM images also demonstrated laser-induced nanogratings were perpendicular to the laser polarization. The naogratings were induced at different pulse spacings. It is obviously can be seen that the period of the nanogratings strongly depends on the pulse spacing or scanning speed. The periodic nanograting structures gradually become more ordered and uniform distribution with increasing pulse spacing. Also, interestingly it is noted that the period at pulse spacing 30nm in Figure 1(b) significantly smaller than that in Figure 1(a) and (c). It means that the period firstly decreases from pulse spacing 5nm to 30nm, gets to a minimum at pulse spacing 30nm, and secondly increases from this point.

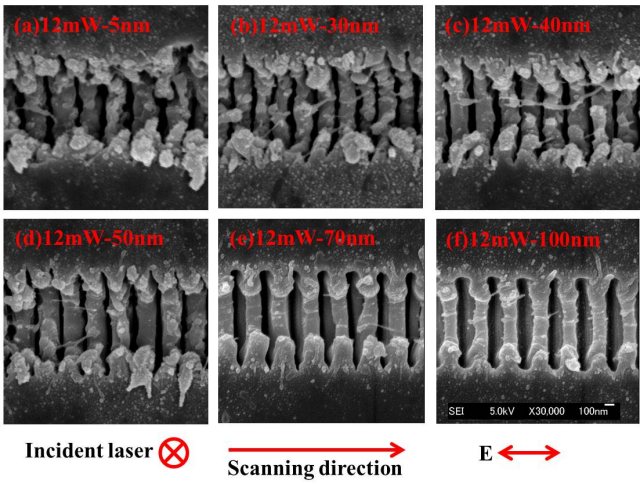

Figure 1 (a-f) SEM images of the laser-induced nanogratings on the surface of SF10 glass after laser irradiation(1KHz, 35fs, 800nm) with the various pulse to pulse spacing at the incident power 12mW. “12mW-5nm” denotes the incident power 12mW and pulse to pulse spacing 5nm (scanning speed 5μm/s), respectively. The double arrows stand for the direction of laser polarization. The scale bar applies to all images is 100 nm.

4. その他・特記事項（Others）

Main collaborators: Quan Sun, Hiroaki Misawa (RIES-Hokkaido University)

5. 論文・学会発表（Publication/Presentation）

なし

6. 関連特許（Patent）

なし