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1. 概要(Summary)

Nanograting structures induced by femtosecond laser pulses in transparent media has attracted extensive attention in many fields. These periodical structures with subwavelength-scale period hold potential in integrated-optics and biomimetic micro-nanodevices and 5D data storage technique. Up to now, it continues to be a hot topic in the field of laser-matter interaction. Despite lots of studies and achievements in nanograting, numerous issues related to mechanism, material dependence and process are still far from completely solved. We will continue to study the nanograting structures induced by femtosecond laser.

2. 実験(Experimental)

【利用した主な装置】

FE-SEM (JSM-6700FT, JEOL).

【実験方法】

Femtosecond laser system (800 nm, 35 fs, 1 KHz, 5 mJ) 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)

Nanograting was generally formed on the focal plane vertical to the laser propagation direction and the direction of the nanograting is perpendicular to the laser polarization direction, as shown in figure 1(a-f). Figure 1(a-f) illustrates the morphologies of the nanograting written on SF10 glass with various scanning speed and figure 1(g) plots the period changes with the pulse spacing. As shown in figure 1(a-f), it can be seen that the pulse spacing plays an important role for the formation of nanograting. The structure of nanograting gradually appears with the pulse spacing increasing. Next the period of nanograting was further analyzed as plotted in figure 1(g). It can be found that the period firstly decreases with the pulse spacing from 10 nm to 70 nm and then it increases to 210 nm at 100 nm. This period trend is different from other transparent materials. For example, for the fused silica, the period will increase with the pulse spacing. The possible reason of this trend may be related to the heat effect or other inherent structure properties of SF10 glass. Therefore, the mechanism of the nanograting of the SF10 glass need to be further studied and this will provide another physical picture on the formation of nanograting.

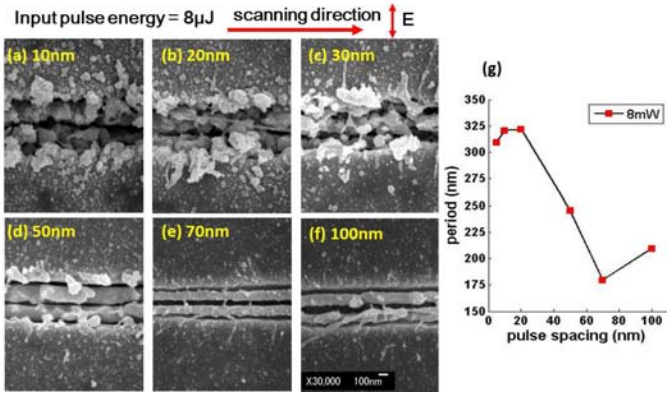

Figure 1 (a-f) SEM pictures of nanogratings on SF10 glass with various pulse spacing. (g) The period of nanogratings changes with the pulse spacing. The input pulse energy is 8 μJ.

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)

N/A

6. 関連特許(Patent)

N/A