

Recent developments on microablation of glass materials using excimer lasers

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Abstract

For many years, the development of effective laser machining techniques for making glass-based micro-components and devices has been a critical factor in the birth of new photonic and biomedical microsystems. In this article, the characteristics and abilities of excimer lasers for micromachining of a wide range of glass materials, including borosilicate glass, fused silica, and quartz, are reviewed and studied. Following the introduction, the special features of excimer lasers are discussed. The typical micromachining system used for glass materials is presented. Then, the fundamental micromachining parameters and the associated morphologies of machined surfaces are evaluated. The approaches by controlling the ablation rate for making the curved surfaces are specifically formulated. Although a wide range of commercially available glasses is covered in this article, two types of the most widely used glasses, borosilicate glass and fused silica, are thoroughly examined to illustrate the complexity in micromachining the glass materials. The procedures to machine single, arrayed, curved microstructures are described. The utilizations of these procedures for making microneedles, optical waveguides, submicron grating, and microlenses are specifically demonstrated. Finally,

recommendations for future efforts are presented.

Keyword : Ablation, curved surface, excimer laser, fused silica, glass, diffraction grating, microlens, micromachining, microneedles, and waveguides