Fabrication of microlens using CO_2 laser and characterization of formation process

by

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Abstract

Microlenses were formed directly on the surface of a glass plate by using a CO_2 laser. This method has the merit of enabling completely dry processing and presents a simple means of microlens fabrication. We discuss the formation process and mechanism on the basis of the characterization of irradiation parameters and the glass composition. When the surface of a glass plate is heated locally to the working point of the glass material with a focused CO_2 laser beam, a microlens is formed owing to surface tension. It was found to be possible to fabricate microlenses easily by controlling the laser power and irradiation time. The shape of the fabricated microlenses was found to be dependent on laser irradiation energy (laser power x irradiation time) and irradiated position. When a Corning 7059 glass plate was used, a convex microlens was obtained at an energy density less than approximately 100 ($\mu J/\mu m^2$). The dynamical stress change of the microlenses was measured in situ by T-FDP (four detectors polarimeter of transmission type) type ellipsometry analysis to elucidate their formation process.

Keywords: CO_2 laser, microlens, focused laser beam, surface tension, glass plate, ellipsometry

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