

Multiple-spot parallel processing for laser micronanofabrication

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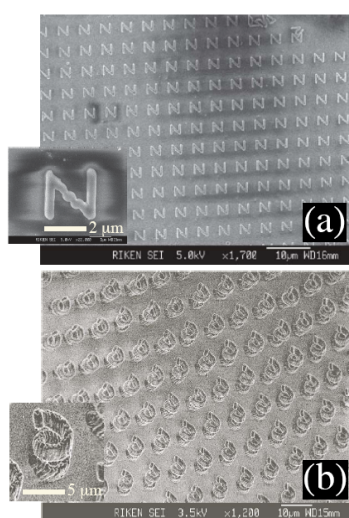


Figure 1: Examples of (a) two- and (b) three-dimensional fabrication with the parallel processing.

A tightly focused femtosecond laser has been established as a unique tool for micronanostructure fabrication due to its intrinsic three-dimensional processing. The spatial resolution beyond the diffraction limit of light has been attained because of the optical nonlinearity of the two-photon absorption (TPA) of polymerization-initiating chromophore and because of the chemical thresholding nature in the resin that was employed [1], [2]. Here, we utilized a microlens array to produce multiple spots for parallel fabrication, giving rise to a revolutionary augmentation for our previously developed single-beam two-photon photopolymerization technology.

Two- and three-dimensional multiple structures, such as microletter set and self-standing microspring array (Figure 1), are demonstrated as examples of mass production. More than 200 spot simultaneous fabrication has been realized by optimizing the exposure condition for the photopolymerizable resin, i.e., a two-order increase of yield efficiency. Moreover, the fabricated structures are aligned periodically, which is determined by the pattern of the microlens array. Therefore, this processing is expected to be useful for also fabricating a periodic structure by utilizing aligned microlenses [3].

References

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