Abstract for an Invited Paper
for the MAR05 Meeting of
The American Physical Society

Three-dimensional micro/nano fabrication with photopolymer for the production of functional microdevices

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Three-dimensional (3D) two-photon microfabrication with 100nm resolution is based on pinpoint solidification of two-photon-absorbed polymerization, which is stimulated by focusing a femtosecond pulsed laser beam inside a photopolymer [1]. The 3D scanning of the laser beam permits the fabrication of any 3D microstructures. This technique has been widely applied to create functional micro/nano devices such as photonic crystals [2] and micromechanical components [3, 4]. Currently the development of 3D photonic crystals is one of the most promising applications. On the other hand, we intend to develop micromachines driven by optical radiation pressure to create novel microtools for biotechnology. We demonstrated that a microgear could be rotated around an attached shaft by means of a laser-scanning manipulation technique [3]. Nanotweezers with submicron probes were also developed [4]. The nanotweezers can be driven with femtonewton order force control. Such optically driven micromachines, including micro pumps and manipulators, will be useful for micro total analysis systems and biotechnology. [1] Opt. Lett. **22**, 132 (1997). [2] Nature **398**, 51 (1999). [3] J. of Microelectromech. Syst. **12**, 533 (2003). [4] Appl. Phys. Lett. **82**, 133 (2003).