†ESI for

Solvents responsive polymer micromachines for micro-manipulation†

Ye Tian, Yong-Lai Zhang, Hong Xia, Li Guo, Jin-Feng Ku, Yan He, Ran Zhang, Bin-Zong Xu, Qi-Dai Chen, Dong-Xiao Lu and Hong-Bo Sun

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† State Key Laboratory on Integrated Optoelectronics, College of Electronic Science and Engineering, Jilin University, 2699 Qianjin Street, Changchun 130012, China Fax: 86 431 85168281; Tel: 86 431 85168281; E-mail: yonglaizhang@jlu.edu.cn; hbson@jlu.edu.cn

b College of Physics, Jilin University, 2699 Qianjin Street, Changchun 130012, China
Experimental Details:

Preparation of photoresist:
In a typical preparation, 0.04g of 2,4,6-trimethylbenzoyldiphenylphosphinoxid and 0.04g of phenylbis (2,4,6-trimethylbenzoyl) phosphine oxide were added into 0.36g butyl methacrylate (BMA). After ultrasonic treatment for 20 min, 0.56g propoxylated trimethylolpropane triacrylate (PO₃-TMPTA) was dropped into the mixture. Then, the mixture was ultrasonic vibrated for another 20 min. The photoresist was protected from light in the entire process and kept in darkness.

Preparation of PBMA:
In a typical preparation, 0.6g of 2,4,6-trimethylbenzoyldiphenylphosphinoxid and 0.6g of phenylbis (2,4,6-trimethylbenzoyl) phosphine oxide were added into 4.8g of butyl methacrylate (BMA). The homogeneous mixture was obtained after ultrasonic vibrated for 20 min. The resin was exposed under UV light for 1h. Finally, a PBMA monolith was obtained.

Fabrication of a suspending microwire:
In our experiments, we utilized a 60×oil immersion objective lens with a high numerical aperture (NA=1.35) to focus the laser into the resin. The central wavelength of the femtosecond laser pulses was 790 nm, the pulse width is 120 fs, and the repetition rate is 80 MHz. The laser focal spot point scanned point by point was accurately controlled by computer program; it depended on a galvano mirror pair in the lateral dimensions and on a piezo stage in the lengthwise dimension. The laser power of polymerization was 6 mW, the exposure duration at each dot was 250μs and scanning step length was 100 nm. After fabrication, the unpolymerized resin was washed out by ethanol.

Fabrication of slipping-block microdevice:
The fabrication process of slipping-block microdevice was similar with microwire. The laser power of polymerization was 6 mW. The laser scanning step length of the cube anchor, the rail and the suspending block was 100nm, whereas scanning step lengths for the fabrication of nanowires were 20nm, 50nm, 100nm, 150nm, 200nm respectively.