MacroNano®

TECHNISCHE UNIVERSITÄT ILMENAU

Optofluidic Microsystems

Single Step PDMS Replication from Micromilled Moulds

Motivation

3D Optical Manipulation is a well established technology within biological applications using high NA microscope objectives. Typically microfluidic set-ups for optical tweezing are built from a polydimethylsiloxane (PDMS) channel system attached to a thin off-the-shelf cover slip. The reasons for choosing PDMS are mainly the good properties for building tight microfluidic systems. Secondly PDMS is highly transparent for laser radiation in the near infrared regime used for tweezing in biological applications and thirdly the ability to replicate structures in a wide range of magnitudes. Starting at feature sizes from a few nanometers for DOE applications to the order of tens of millimetres for building whole systems. Within this system the cover slip is replaced by a thin PDMS membrane used as an optical interface for tweezing applications.

Fabrication and Replication

Micromilling is a promising technolgy for the fabrication of surface profiles with good optical quality and low surface roughness. This technology can be used to fabricate moulds for replication of optofluidic system. Figure 1 shows the two moulds for the replication of a micro fluidic system in a single step (Fig. 2). The PDMS sytem already includes the reservoirs and the channel system as well as the optical interface for a high numerical immersion fluid microscope objective. This interface surface shows good optical properties in darkfield imaging (Fig. 3) as well as in a white light interferometer with surface roughness down to R =40nm.

Optical Trapping

The approach for optical manipulation through a 170µm thin PDMS membrane was demonstrated in an experimental setup (Fig. 4).

Fig. 1: Micromilled PMMA moulds.

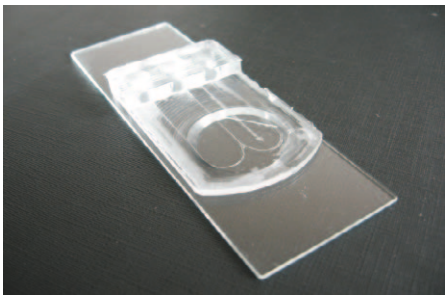

Fig. 2: Replicated PDMS optofluidic system for optical manipulation by a laser.

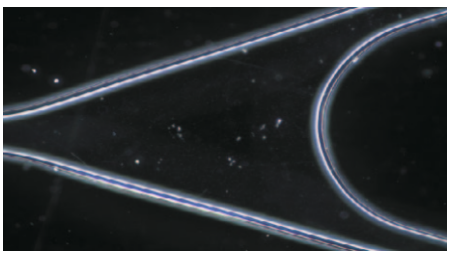

Fig. 3: Surface of the channel (20x darkfield microscope image) .

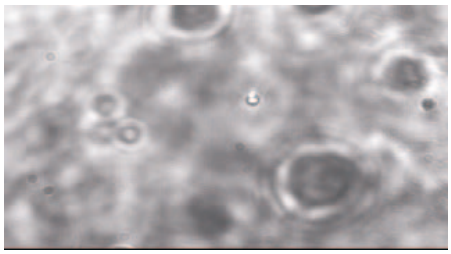

Fig. 4: 3μm particle trapped in laser focus.

Department of Mechanical Engineering
Institute of Micro- and Nanotechnologies
FG Technische Optik
Prof. S. Sinzinger

Phone +49 3677 69-2490
Fax +49 3677 69-1281
stefan.sinzinger@tu-ilmenau.de
www.tu-ilmenau.de/optik