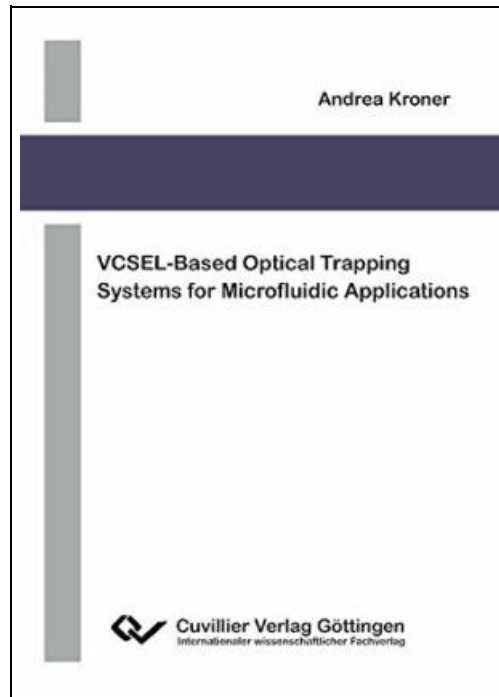


VCSEL-Based Optical Trapping Systems for Microfluidic Applications



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Reviews

Complete guideline for publication fanatics. It is actually written in straightforward words rather than confusing. I am effortlessly could get a pleasure of looking at a written book.

(Kirstin Schuppe)

VCSEL-BASED OPTICAL TRAPPING SYSTEMS FOR MICROFLUIDIC APPLICATIONS



Cuvillier Verlag Mrz 2016, 2016. Taschenbuch. Condition: Neu. Neuware - Optical trapping and manipulation by laser beams offers the unique possibility to handle single micrometer-sized particles such as living cells without any mechanical contact, damage or contamination. A second hot topic in biology is microfluidics, where the examination of biological samples in channel structures with widths below 100 μm reduces the used sample volume significantly. While the combination of both techniques results in attractive lab-on-a-chip structures for particle sorting and analysis, the commonly bulky trapping setup is contradictory to the miniaturized concept. Here, the use of vertical-cavity surface-emitting lasers (VCSELs) as light sources in optical trapping systems allows a strong reduction of the setup complexity owing to the small dimensions, low cost and high beam quality of these devices. This thesis gives a detailed study on optical manipulation systems based on vertically emitting laser diodes. A standard optical tweezers setup as well as a novel, miniaturized system, the so-called integrated optical trap are investigated. The latter aims for particle separation and sorting in microfluidics resulting in low-cost, portable modules. A classical optical tweezers system based on a high numerical aperture objective in combination with a VCSEL light source is investigated. Standard multi-mode as well as single-mode surface relief VCSELs are used as laser source. With both kinds of VCSELs, optical trapping of polystyrene particles of sizes ranging from 4 to 15 μm is demonstrated with some milliwatts of optical power at the sample stage. A maximum trapping force of 4.4 pN for 15 μm particles is achieved with the multi-mode laser, proving the suitability of multi-mode lasers for optical manipulation despite their inferior beam profile. By using two-dimensional VCSEL arrays instead of solitary lasers, the system is extended to a multiple optical tweezers setup in a straightforward manner. To avoid any...



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