Optical Waveguide Manipulation of Micro- and Nano-spheres

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Optical tweezers are well-established as a tool for non-contact, non-destructive handling of biological materials [1] and of inorganic nanospheres attached to biological molecules [2]. Recently, interest has grown in optical manipulation at surfaces [3] potentially as part of the toolbox of the "lab-on-a-chip". In particular, advances have been made in trapping and propulsion of metallic and dielectric micro- and nano-particles in the evanescent fields of optical waveguides [4, 5], which may form part of a planar microsystem into which optical detection and spectroscopy of separated species could also be integrated. Optical waveguides embedded in surfaces represent a powerful means of controlling the distribution of optical intensity and intensity gradient at such surfaces, for particle control.

In this paper, the design of optical waveguides and waveguide devices for trapping, propulsion and sorting of gold nanospheres and latex microspheres [6, 7] will be described and recent experimental results presented and compared with theoretical models. The implications of these results for some proposed applications in the biosciences will be discussed.

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