



LIFTSYS – LASER PRINTING SYSTEM FOR CELLS AND BIOMATERIALS

Task

The manufacture of biological testing systems is often confined by the viscosity of the biological materials applied to an analysis chip. Up to now, printing technologies have required highly aqueous carrier solutions and have not allowed the analyte to be positioned with pinpoint precision. Glycoproteins, living cells or metals can only be partially printed with conventional systems. A technology with which biomolecules and cells can be placed with micrometer precision in any arrangement needed on a substrate would enable new possibilities in high-throughput or high content screening.

Method

The LIFTSYS system, which the Fraunhofer ILT developed using laser-induced forward transfer (LIFT), makes it possible to place the smallest amounts of biological materials or even individual living cells precisely and without any restrictions. A receiver substrate is situated beneath a transfer substrate, a glass slide, bearing the biomaterial to be transferred on its underside and an intermediate titanium absorber layer. A pulsed laser beam evaporates the titanium layer, and the resulting forwards impulse transfers the biomaterial onto the receiver substrate. This laser-based process functions without a printing head and can transfer biomaterials such as RNA, DNA, proteins and cells independent of viscosity.

Result

As a result of its technical development upon the device, Fraunhofer ILT has created an innovative technology – a five-axis tool with positioning systems for transfer and receiver carriers. The integrated beam source can be adjusted to the wavelengths 355 nm or 1064 nm. Focusing position, laser power and pulse number can be automatically regulated. This enables the user to transfer a wide range of substances, from biomaterials to metals, with the LIFTSYS machine. The tool also enables users to program complex transfer patterns and assign them to a specific processing result.

Applications

A wide field of applications is, for example, medical and pharmaceutical research, in which the reaction of cells to active substances is examined. In particular, the system can be used to reproduce basic investigations of microscopic interactions of different cells with each other. With LIFTSYS, microstructures can, furthermore, be fabricated from different technical materials for the manufacture of sensors or bio-hybrid sensor systems.

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1 LIFTSYS tool in the laboratory.

2 Set-up of a cell-based test system by means of LIFT.