



LIFTSYS® – LASER PRINTING SYSTEM FOR CELLS AND BIOMATERIALS

Task

When biological test systems are produced, the viscosity of the biological agents to be applied to an analysis chip is often a limiting factor. To date, conventional printing techniques require highly aqueous carrier liquids and do not allow accurate positioning of the analyte. Furthermore, glycoproteins, living cells or solids can only be conditionally printed using such systems. There is, however, a new technique that allows biomolecules and cells to be placed on a substrate with micrometer precision in any arrangement, thus opening up new possibilities in high-throughput or high-content screening.

Method

The LIFTSYS® system developed at Fraunhofer ILT along with laser-induced forward transfer (LIFT) make it possible to precisely place very small quantities of biological substances, or even single living cells, on a substrate with almost no restrictions. Above the recipient carrier, a commercially available microtiter plate or a slide, there is a transfer carrier with the biomaterial to be transferred on the underside. A pulsed laser beam creates a vapor bubble, which induces a jet to form after collapsing. The jet then transfers a small amount of sample material onto a substrate. This laser-based process eliminates the need for a nozzle print head and can deliver biomaterials such as RNA, DNA, proteins, and cells independent of viscosity.

1 Process chamber for Raman analysis and Laser Induced Forward Transfer (LIFT).

2 LIFTSYS® system in the laboratory.

Result

The LIFTSYS® platform is a five-axis system with motion systems for transfer and receiver carriers. The integrated beam source can be set to wavelengths in the UV (355 nm) or NIR to MIR (1, 6 µm - 2,95 µm). Focus position, laser power and pulse rate can be regulated automatically. All of this allows the user to transfer a wide range of substances, from biomaterials to metals, with the LIFTSYS® system.

Optional Components

- Epi- or transillumination
- Integration of different holding devices (vacuum chuck, clamp carrier, etc.)
- MIR laser system for absorber layer-free transfer
- Image processing
- Fluorescence spectroscopy
- Raman analysis

Transfer Materials

- Biomaterials and proteins
- Hydrogels (with biological material)
- Solids
- Bio inks

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