Stage I - 14.12.2007

Documentation and literature studies regarding LIFT applicable to different materials

Objectives of the execution phase

1) completing the experimental system through the acquisition of a nanosecond laser system working at 193 nm (ArF excimer laser) and a Secondary Ion Mass Spectrometer (SIMS);

2) accomplishing the conditions of contract for the acquisition of the ArF excimer laser and the SIMS (Secondary Ion Mass Spectrometry) system for the characterization of the thin films and complex micron and nano-sized heterostructures

Summary

It was studied the specialty literature to identify the best experimental conditions in order to achieve a controlled transfer through Laser Induced Forward Transfer (LIFT) as well as to widen the applicability of this technique. LIFT technique represents a novel deposition and nano / micro-structuring method for materials.

This method consists in the transfer of a material previously deposited onto a substrate (named donor) that is transparent to the laser radiation under the shape of a pixel with dimensions that depend upon the area and the shape of the laser spot. The receiving substrate and the donor are positioned parallel and at a sub-millimetre distance. The LIFT technique may be used for the transfer of any type of material: metals, oxides, living cells and even DNA.

LIFT is one of the few techniques that allow polymer patterning and obtaining sharp edges, due to the fact that the photolithographic techniques result in structures with an unregulated shape. Related to this technique there must be taken into consideration a few important aspects that are connected to the type of material that shall be transferred, the wavelength used and the type of interaction with the material to be transferred.

Generally, if the material to be transferred is deposited directly onto the transparent substrate, at the interface between the film and the support may appear partial ablation of the film, which in the case of ceramic and metallic materials does not induce severe consequences. In the case of polymer and biologic materials maintaining intact their composition and structure is essential. In order to avoid the degradation process between the layer to be transferred as a pixel and the support a layer of polymeric material that is highly absorbent to the wavelength of

the laser that is used. This layer shall take over most of the incident laser energy, shall be ablated and shall push through the shock wave induced the deposited material onto the receiving surface, This intermediate layer is called dynamic release layer.

Organic materials (including biomolecules) i.e. cells, proteins, etc. may be transferred onto a substrate using a solvent method Matrix Assisted Pulsed Laser Evaporation – Direct Write (MAPLE-DW). In MAPLE-DW, a material that is transparent to the laser wavelength used is covered with the material to be transferred and an organic ligand. When the focused laser beam hits from the backside this mixture, a part of the ligand is decomposed and transfers the material onto the receiving substrate. In this way, the organic molecules are desorbed/ablated from the target without significant decomposition and form a thin film on the receiving substrate.

The ArF excimer laser and the Secondary Ion Mass Spectrometry (SIMS) system shall be used for the characterization of the micro and nano structured complex heterostructures.

There were accomplished conditions of contracts for purchasing the excimer laser and the SIMS system through open auction. The conditions of contract are annexed to this report. The purchase announcements were published on the SEAP site (www.e-licitatie.ro).