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**Laser-induced backward transfer of intact nano-structured polymer deposits**

Laser-induced forward transfer (LIFT) is a technique for printing thin-film materials in a solid or liquid state from a pre-prepared donor to an adjacent receiver, and has been investigated by many groups worldwide since its first demonstration 30 years ago [1]. More recently a variant of this technique, known as laser-induced backward transfer (LIBT), has shown the potential for printing materials in a reverse geometry, and while not yet as developed as the LIFT technique, offers considerable advantages in terms of intact printing of solid-phase materials. While LIBT has different requirements in terms of transparency of the donor film to the incident laser pulse, we believe the different mechanisms involved in LIBT offer an interesting alternative for applications where intact printing is required, with the minimum of associated debris.

The LIBT experiments were carried out using a Ti:sapphire laser oscillator and amplifier with a central wavelength of 800nm and a pulse duration of ~150fs. The spatial intensity profile of the laser output was homogenised to evenly illuminate the surface of a digital micromirror array (DMD). The DMD was used as a dynamic object mask to project chosen spatial intensity patterns with a demagnification of x20 or x50 to the LIBT set-up, as described in [2]. Donors were fabricated via spin-coating of S1813 and SU-8 photoresists onto cleaned silicon carrier substrates that had pre-patterned rib waveguide structures with lateral features in the ~200nm range.

Deposits have been LIBTed from these polymer donors, whose thickness varied from 1.4µm to 2.25µm, at threshold laser fluences of between 130–260mJ/cm2 with typical overall dimensions in the range of 20-50µm. Of particular note is the fact that the transferred pixels retain the surface structuring present in the carrier substrate and results obtained so far have demonstrated surface relief features with dimensions of ~200nm width and ~250nm in depth. We believe the laser materials interaction in LIBT is beneficial for such intact and templated transfer, and see this as an interesting and novel extension of the more established LIFT process. Our aim is to demonstrate faithful transfer of pixels with large aspect ratios, with lateral dimensions in the region of 100nm or less.

1. J.Bohandy, B.F.Kim, and F.J.Adrian, J.Appl.Phys. **60**, 1538–1539 (1986).
2. D.J.Heath, M.Feinaeugle, J.A.Grant-Jacob, B.Mills, and R.W. Eason, Optical Matererials Express **5**, 1129 (2015).