Dr. Walter PERRIE, Senior Researcher
University of Liverpool
School of Engineering, Laser Group
Brownlow Hill L69 3GH, Liverpool L69 7ZX
United Kingdom

Email: wpfemto1@liverpool.ac.uk

Advanced Materials Micro-structuring with Ultrashort Lasers

Abstract

The control of intensity and polarisation of light are useful in ultrafast (τ< 10ps) laser-materials interactions hence relevant to laser based manufacture. Liquid crystal on Silicon based Spatial Light Modulators (LCOS SLMs) are programmable diffractive optics able to dynamically alter laser wavefront and polarisation, relevant to applications such as micro-electronics fabrication, structured illumination in microscopy and coherent control in Quantum Optics. They can also speed laser-materials fabrication through structured light fields. SLMs are addressed by appropriate Computer Generated Holograms (8 bit grey level maps) and how they modulate light will be explained.

This seminar will also discuss both linear and non-linear light-material interactions, the latter induced by ultrahigh intensity femtosecond laser pulses, easily able to create intensity I> 10^{12} Wcm^{-2} at a material surface or inside a transparent dielectric. Such short optical pulses minimise thermal diffusion effects during absorption. On surfaces, precision micro-structuring of metals and thin films will be demonstrated while inside dielectrics, refractive index modification can be achieved - useful for inscription of photonic components such as Volume Bragg gratings or material identification marks.

We will also present recent results performance of LCOS devices when exposed to high average power laser exposure P> 100W showing that these devices are robust for future industrial applications.

Figure 1 (left) demonstrates SLM beam splitting of high energy femtosecond laser pulses to a 4 x 4 uniform array with more optimum energies for surface modification. On the right, high speed 9 beam parallel spot picosecond laser ablation of thin film Al/PET is demonstrated.

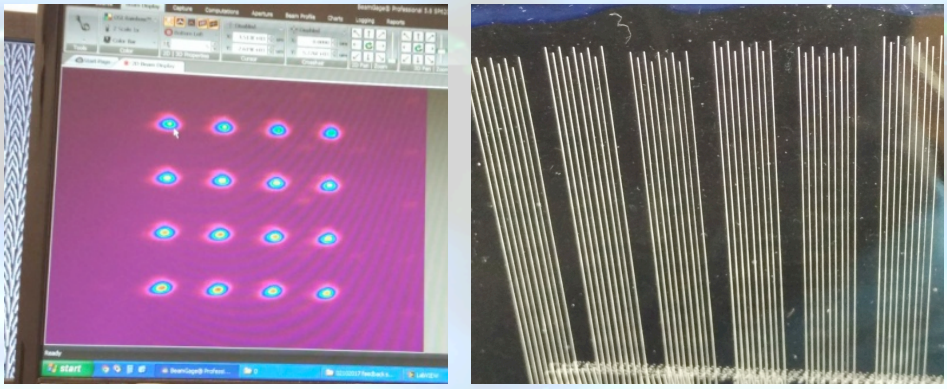

Fig. 1 Spot array generated using SLM (left) and parallel beam ablation on thin film AL/PET (right).