Laser induced micro plasma processing of polymer substrates for biomedical implant applications

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Abstract
This presentation reports the experimental results of a new hybrid laser processing technique; Laser Induced Micro Plasma Processing (LIMP²). This novel laser processing method is a new addition to a number of techniques that were initially developed in Japan. Laser Induced Plasma Assisted Ablation (LIPAA), was first developed by Zhang et al at RIKEN and uses both the laser beam and the induced plasma to machine a transparent substrate. A transparent substrate is placed on top of a medium that will interact with the laser beam and create a plasma. The plasma and laser beam act in unison to ablate material and create micro-structuring on the “backside” of the substrate. We report the results of a series of experiments on a new laser processing technique that will use the same laser-plasma interaction to micromachining structures into glass and polymer substrates on the “topside” of the substrate and hence machine non-transparent material. This new laser processing technique is called Laser Induced Micro Plasma Processing (LIMP²).

Micromachining of biomedical implants is proving an important enabling technology in controlling cell growth on a macro-scale. This paper discusses LIMP² structuring of transparent substrate such as polymers for this application. Direct machining of these materials by lasers in the near infrared is at present impossible. Laser Induced Micro Plasma Processing (LIMP²) is a technique that allows laser operating at 1064 nm to machine microstructures directly these transparent substrates.
Experimental Set up for LIMP²

White light interferometer images of a LIMP² processed polymer surface seed with 100,000 cells. The image shows how cell adhere to the LIMP² Processed surface.