UTILISATION OF LASER PROCESSING TECHNOLOGIES FOR SPECIES SEPARATION AND SURFACE SCIENCE APPLICATIONS

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Laser processing is utilised in a wide variety of applications for chemical and biological species separation and detection. In this presentation, the use of Nd:YAG and Nd:YVO4 lasers are demonstrated for the ablation of thin films of cyclic olefin copolymer (COC). Subsequent bonding of these films allows for the fabrication of multi-layered 3D microfluidic channel systems. Within such systems, the deposition of gold nano-clusters will be demonstrated as a means of fabricating functional total analysis system surfaces. Such functional surfaces are important for the future developments with biochemical sensing. Silica extraction medium can also be functionalised with C-18 for example. Centrifugal micro-fluidic devices embedding six independent C18-functionalised silica particulate columns have recently been developed for extraction and preconcentration in bioanalytical and environmental applications. Results of using such systems for extraction of vitamin B12 from real biological samples will be presented. Silica and carbon monoliths have also been integrated into centrifugal micro-fluidic platforms for extraction and preconcentration of phenols from spiked tap-water samples. Fabrication methods of such systems as well as results will be presented using the carbon monolith-based micro-fluidic platforms. Fabricated carbon monoliths based on a silica bead template typically have a very lacy structure but do not contain significantly high levels of nano-scaled porosity. In recent work, functionally modified silica (FMS) utilising C60 was prepared a template for carbon monolith fabrication. This structure provides the basis for a significant level of nano-porosity with associated rise in surface area and hence ability for solid phase extraction (SPE). Pores in such carbon monoliths, which are very fragile, can be closed easily by conventional blade cutting. Laser ablation, via CO_2 laser, of such monoliths not only allows for these structures to be shaped to fit separation systems but also provides a means of controlling the type and extent of carbon allotrope present on the surface. Such fine control of surface properties will be shown to have a significant influence on surface absorption and solid phase extraction.