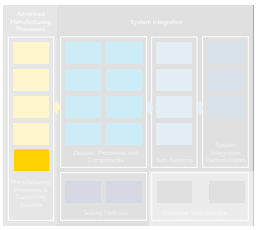

STUDENT

ADVANCED MANUFACTURING PROCESSES

Patterning strategies for integration of multifunctional organic materials (PASMOMA)

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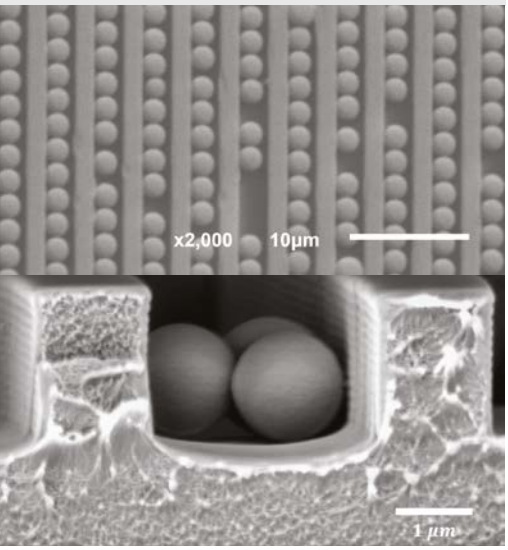
The objective of the 'Patterning Strategies for integration of Multifunctional Organic Materials' (PASMOMA) project was to develop high-resolution patterning of multifunctional materials without the use of complex lithography methods and to scale the technique up for the fabrication of large-area multifunctional arrays for photonic and electronics applications. This work is now being continued by Shengyang Chen–funded by an Imperial College CSC scholarship-as his PhD topic.

One promising strategy developed in the project is "nano-pinballing" which uses convective self-assembly (CSA) to deposit nano- to micro-sized particles of functional materials into surface relief structures in a controlled manner under the action of solvent evaporation and capillary forces.

The project has achieved controlled and patterned deposition of insulating, conducting and light-emitting nanoparticles from microemulsions onto patterned substrates over areas as large as 2 x 2 cm^2 and demonstrated that a variety of complex, hierarchical architectures can be produced with intriguing optical characteristics. A laser characterisation rig has been set up and 2D diffraction patterns used to calculate the periods of the ordered arrays of nanoparticles.

Key results

1. Different sizes of micro- or nanoparticles can be deposited into grooves homogeneously and with an ordered structure;
2. There is some potential for scaling up the process for larger area (e.g. by adjusting the amount of the colloidal suspension and the size of the blade), although the deposition process is currently slow.



Above **Polystyrene particles**
Good filling and well-ordered structures can be achieved with the model system of polystyrene particles deposited into channels of width 2 microns

Below **Conjugated polymer particles**
Conjugated polymer particles (polyfluorene-co-vinylbenzene) were deposited into patterned structures and good alignment was achievable