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Multi-Physics Modelling for the Fabrication, Packaging and Reliability of Micro-Systems Components

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ABSTRACT

The latest advances in multi-physics modelling both using high fidelity techniques and reduced order and behavioural models will be discussed. Particular focus will be given to the application and validation of these techniques for modelling the fabrication, packaging and subsequent reliability of micro-systems based components. The paper will discuss results from a number of research project with particular emphasise on the techniques being developed in a major UK Government funded project – 3D-MINTEGRATION (www.3d-mintegration.com).

Figure 1 details the interdisciplinary framework behind the 3D-Mintegration approach. Both high fidelity models, based on the solution of highly coupled non-linear partial differential equations, and reduced order models are being developed. Both of these solution techniques are being embedded within an optimisation framework.

Figure 1: An integrated approach to building Micro-Engineered Components

A number of simulations will be demonstrated for 3D-Processing, Micro-assembly, Packaging and Test. The integration of these simulations for (i) micro-fluidic device for blood analysis, (ii) a micro-probe for 3D metrology, and finally (iii) a Health Monitoring device for aircraft wiring systems will be demonstrated and discussed. Following figure illustrates the modelling and simulation framework being developed.

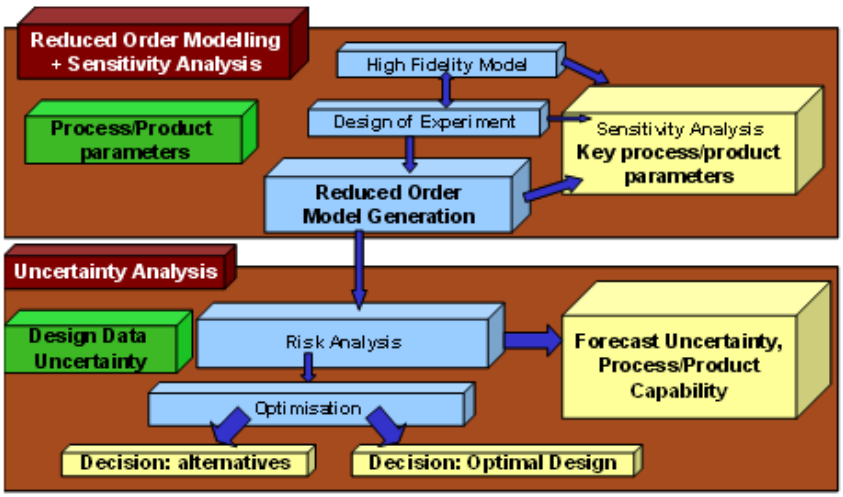

Figure 2: 3D-Mintegration - Simulation Framework

The following figure details some of the associated with the above processes. The presentation will detail the multi-physics technology used for each of these calculations. Also how reduced order models and uncertainty analysis are used to help identify process and product capabilities to ensure six-sigma reliability or the final micro-system part

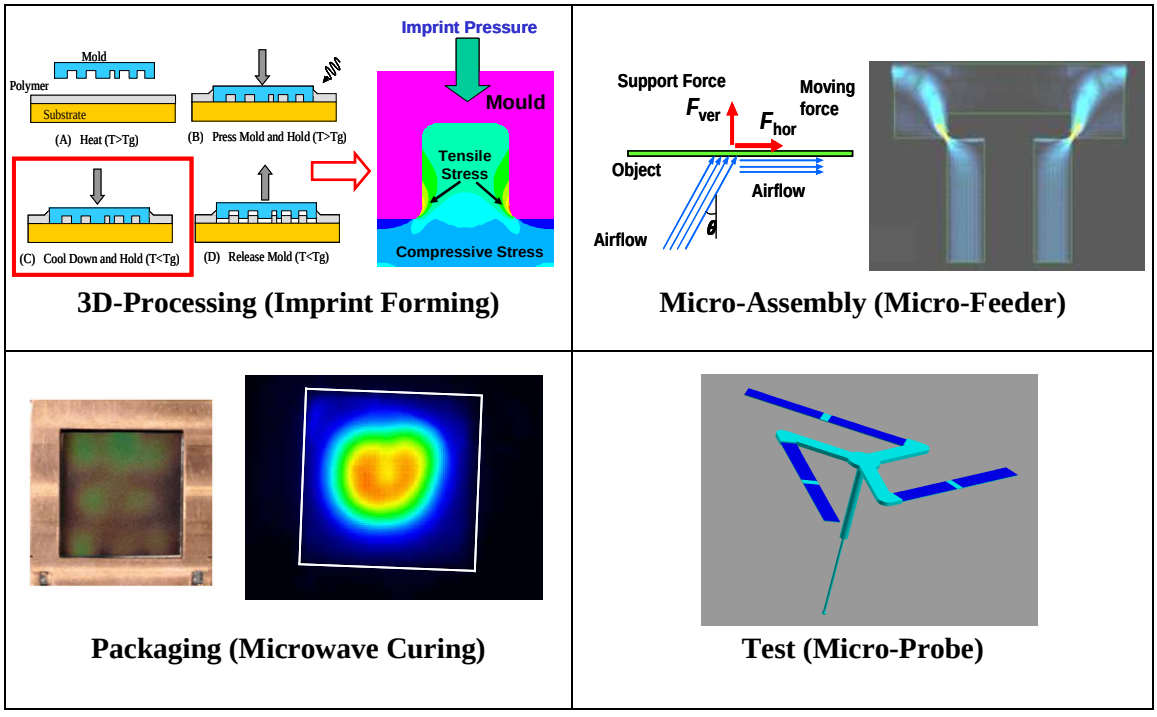

Figure 3: High fidelity calculations for some of the 3D-Mintegration Processes

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