

Editorial

In this issue, we invited five winners of the 'Best Paper Awards' at the 4th International Conference on Advanced Research in Virtual and Rapid Prototyping, Leiria, Portugal, 6–10 October 2009, to enhance their conference papers to the standard of an international journal. One paper each from 'Materials' track, 'Biomanufacturing' track and 'Virtual Environment & Simulation' track and two papers from 'Advanced Rapid Prototyping Technologies and Nanofabrication' track.

In the first paper, Hao *et al.* describe the development of a novel fabrication method known as 'chocolate additive layer manufacture' or 'ChocALM'. The system has been developed for the layer-by-layer fabrication of creative and personalized 3D chocolate products. In this paper, the material and property behaviour of commercial chocolate were investigated. Results revealed that process parameters such as extrusion rate, nozzle velocity and nozzle height were critical for successful deposition of chocolate and the optimisation of these parameters enabled the ChocALM system to create 3D chocolates with appropriate quality.

Similar to the first paper where extrusion was used, in the second paper Domingos *et al.* propose a novel extrusion-based technology called 'BioExtruder'. However, in this case, biocompatible and biodegradable poly(ϵ -caprolactone) (PCL) porous structures were fabricated as tissue engineering scaffolds. The *in vitro* degradation behaviour in both simulated body fluid (SBF) and phosphate buffer solution (PBS) were investigated over 6 months. The characterization of the degradation behaviour of the structures was performed at specific times by evaluating changes in the average molecular weight, the weight loss and its thermal properties. Morphological and surface chemical analyses were also performed using scanning electron microscopy (SEM) and X-ray photoelectron spectroscopy (XPS), respectively.

A new digital chain for additive manufacturing (AM) processes was the subject of the third paper by Bonnard *et al.* AM is, nowadays, an aloft process just as most traditional processes such as machining are. However, there still remains a domain where this process is not very competitive and that is its digital chain. Indeed, it is too poor in information to allow for the development of advanced AM operations and therefore to compete with

the traditional processes. The authors propose to use the STEP-NC concept, which contains high-level information, in order to integrate the adding material processes in a complete STEP-NC digital chain in accordance with the norm work group committee *ISO TC 184/SC 1*. This paper also proposes to develop this digital chain with a classical CNC controller, which is also present in machining machines, and to hence benefit from their development possibilities

In the first of the first two papers devoted to 'selective laser melting (SLM)', Yasa *et al.* propose a method to make it possible to create fully functional parts directly from standard metals without any intermediate binders or any additional post-processing steps. During SLM, a high intensity laser beam selectively scans a powder bed according to the CAD data of the part to be produced and powder particles are completely molten. SLM is capable of producing near full density parts with an almost infinite geometric freedom. However, the mechanical properties obtained with SLM may differ from the ones of bulk material. In this study, Charpy impact tests were applied on the samples produced by SLM from different materials; Ti-6Al-4V, AISI 316L (X2CrNiMo18-14-3) and maraging steel 300 (X3CoMoTi18-9-5). The influence of building axis as well as of various heat treatments applied on the samples after SLM was investigated. The evolution of the microstructures of the sample parts was also studied.

In the second of the papers devoted to SLM, Jhabvala *et al.* emphasize the need to balance between power and scan speed in the SLM process. When small scan speed is used, thermal gradients are important and local solidification can lead to cracks. On the other hand, when high speed is used, the power has to be huge and phenomena due to heat transfer, like delamination or balling, arise. In this paper, they studied different possible scanning strategies which led to a homogeneous heating of the part until its melting point. The results were compared to numerical simulations.

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