

# 3D Deposition of Functional Materials for the Additive Manufacturing of Smart Devices

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## Abstract

As is now widely recognized, Additive Manufacturing offers many potential advantages to both users and industry, with one of the principal benefits being in the extended levels of design freedom and complexity that can be incorporated into a component. For single material additive manufacturing – most notably the powder bed fusion techniques, which are of particular relevance and interest to industry today – we are beginning to see examples emerging that incorporate complex lattice structures or components that involve a degree of topology optimization or parts consolidation in their design. Though many of these emerging examples are impressive, by their single material nature, they also are limited to being used as “passive” components that require integration into a larger system in order to impart functionality beyond the mainly structural.

However, taking the concept of design freedom beyond the geometrical domain to one where multiple materials are simultaneously deposited opens up the potential for the creation of functionalized, “active” devices “printed” in one build operation. However, though simple in concept, this discrete deposition of dissimilar materials throughout the volume of a part creates significant technical challenges, particularly in the deposition of useful materials.

In this presentation, the author will focus on the current activities of the research group at Nottingham where there is an emphasis on multifunctional Additive Manufacturing. This research is predominantly, but not exclusively, utilizing jetting based technologies for the co-deposition of both structural and functional materials for electronic, pharmaceutical and biological structures and devices and varying length scales.

## Author Biography

*Richard Hague is Professor of Innovative Manufacturing in the Department of Mechanical, Materials and Manufacturing Engineering at the University of Nottingham, Head of the Additive Manufacturing and 3D-Printing Research Group (3DPRG) and Director of the EPSRC Centre for Innovative Manufacturing in Additive Manufacturing. He has been working in the AM field for 20 years and has a background of leading and managing large multi-disciplinary, multi-partner research projects. Prof Hague's research interests are focused on AM specific processes, materials and design / design systems across a wide spectrum of industrial sectors with a particular interest in design / design systems; current research programmes are focused on the design and production of multifunctional additively manufactured devices. He is also Chair of the International Conference on Additive Manufacturing & 3D Printing and active within the ASTM F42 AM Standards initiative.*