

2<sup>nd</sup> International Conference on

# 3D Printing Technology and Innovations

March 19-20, 2018 | London, UK

## Additive manufacturing of metal-ceramic metamaterials for RF communications

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Metamaterials is a class of engineered materials with properties not found in nature. For Radio frequency (RF) communications these materials are envisaged to be used for planar antennas and RF devices where advantages are obtained by engineering the permittivity and permeability of the composite structure. Metamaterials for RF communications include those comprising of sub-wavelength highly ordered arrays of conductive materials embedded in a dielectric host material. Metals are the obvious choice for the conductive part and ceramics offer a high permittivity and low loss dielectric host medium. Additive manufacturing (AM) enables remarkable flexibility in the level of geometric complexity and lends itself well to the manufacturing of 3D metamaterials. Although AM of metals is well established, AM of combined metal-ceramic is still only at the research stage. Especially the high sintering temperatures required for ceramic manufacturing makes the process non-compatible with metals. In this project we use a dispensing system and localized laser processing to manufacture metamaterials.

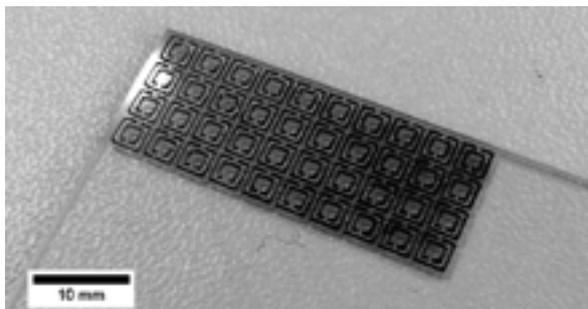


Figure 1: a) Printed split ring resonator.

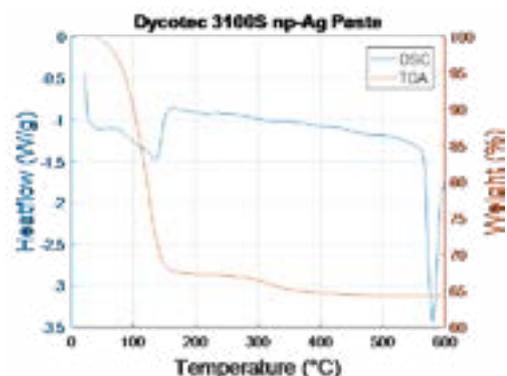


Figure 1: b) TGA and DSC of the printed Ag nanoparticle ink.

## Biography

Daniel S Engstrom has completed his PhD from the Technical University of Denmark (DTU), Denmark and followed it by Postdoctoral positions at Imperial College London, University College London and University of Oxford, UK. He has been a Lecturer in Additive Manufacturing since 2015 at the Wolfson School of Mechanical, Electrical and Manufacturing Engineering at Loughborough University, UK as a part of the Additive Manufacturing Research Group (AMRG). His research interest includes: AM of Electronics and Metamaterials, Nanoscale AM and Embedded Electronics.

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