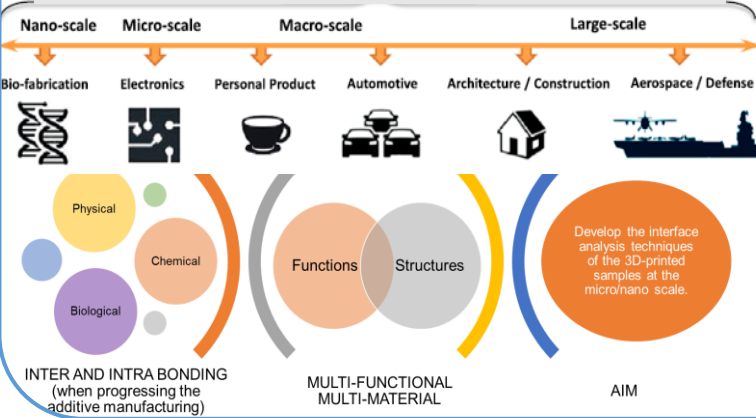




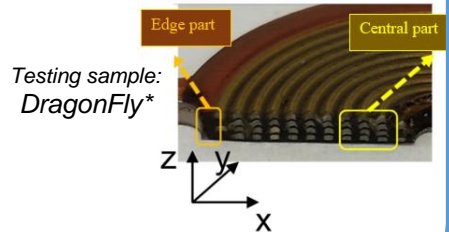
A. Overview - Aim

Additive Manufacturing (AM) or 3D-printing has many applications or impacts



There are different 3D-printed inks and products in healthcare, engineering, and other industries.

An inkjet 3D printed product (commercial electromagnet example)



(* An inductor has an insulated wire wound into a coil around a core. The core is made of dielectric material and the coil is assigned with different circular connected layers.

B. Expose the interfaces

Ultramicrotomy



•Preparing the liquid plastic resin and treating with silane

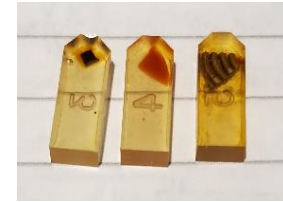
•Drying in the vacuum oven at 60-70°C/48h

•Using the glass knife

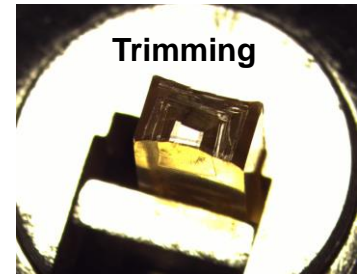
•Using the diamond knife

•Wet sectioning onto SEM stubs or TEM grids

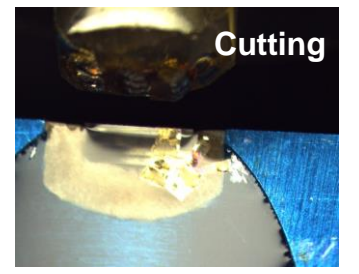
Embedding & Polymerising



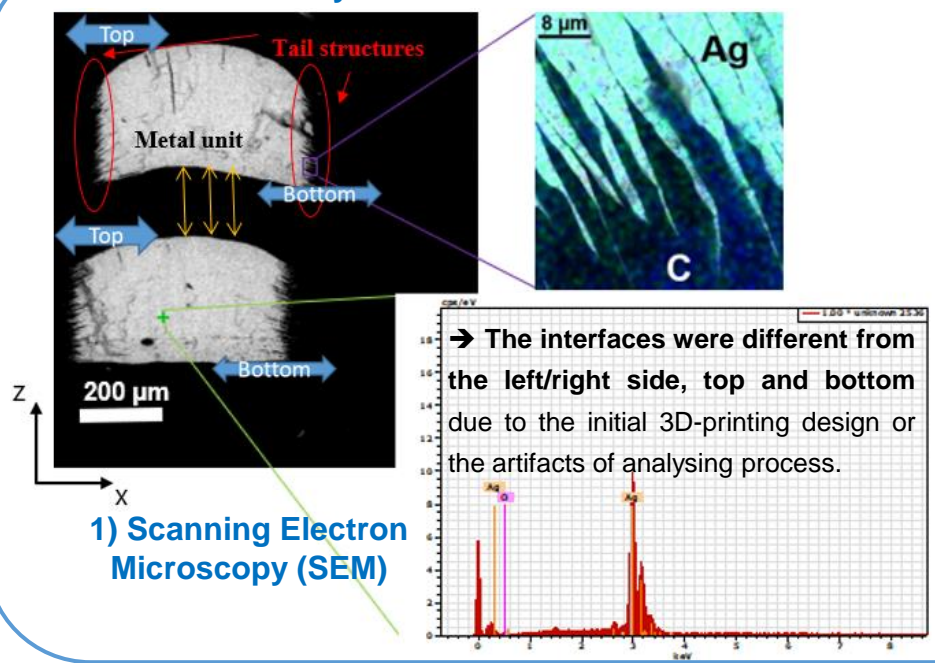
Trimming



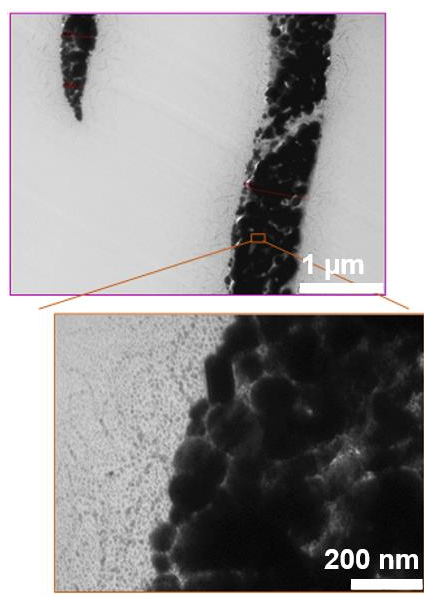
Cutting



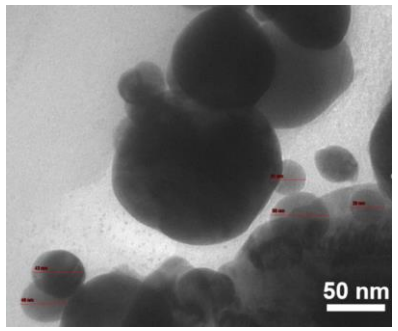
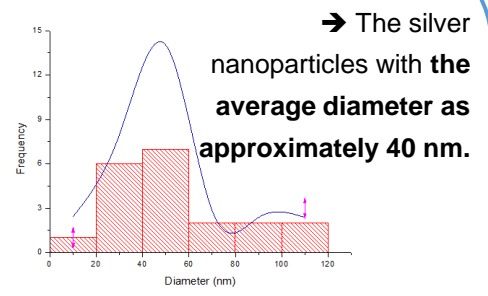
C. Analyse the interfaces



2) Transmission Electron Microscopy (TEM)



3) Data interpretation



D. Conclusions - Future works

- Confirm the repetitive nanostructures of metal-polymer. SEM and TEM with Ultramicrotomy for cross-sectioning are reliable as the first steps to analyse and confirm the morphology of the 3D-printed product.
- Further analyses should be tested to ensure the functions of different layers and interfacial areas.

E. Acknowledgements - References

- Acknowledgements: Programme Grant (EP/P031684/1), Nanoscale & Microscale Research Centre, and Nano Dimension Company.
- References:
 - 1) W. Gao et al., "The status, challenges, and future of additive manufacturing in engineering," CAD Comput. Aided Des., 2015, vol. 69, pp. 65–89.
 - 2) M. Zenou and L. Grainger, "Additive manufacturing of metallic materials," in Additive Manufacturing: Materials, Processes, Quantifications and Applications, 2018, pp. 53–103.
 - 3) J. W. Stansbury and M. J. Idacavage, "3D printing with polymers: Challenges among expanding options and opportunities," in Dental Materials, 2016, vol. 32, no. 1, pp. 54–64.