

FIGHTING INFECTION WITH 3D PRINTING AND SILVER

Morgan Lowther

Prof. Liam Grover

Dr. Sophie Cox

School of Chemical Engineering



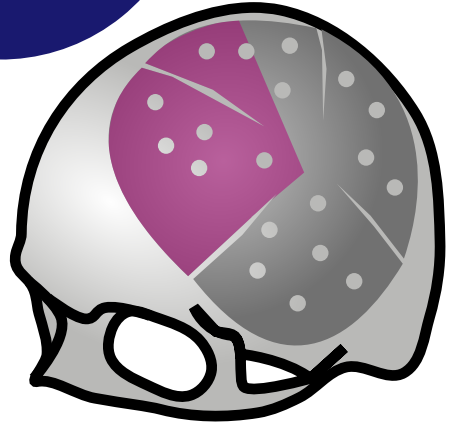
mxl782@bham.ac.uk



@AdditiveMorgan

Why do we need this?

22% of joint implant removals and replacements are due to infection^[1]



up to **20%** of cranioplasties will become infected^[2]

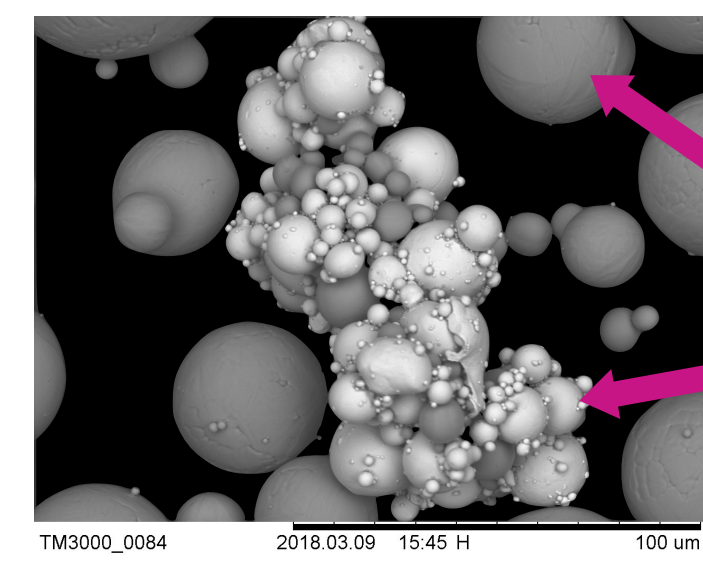


disrupts biofilms and damages bacterial DNA^[3]

- [1] - 14th Annual Report, National Joint Registry (2017)
[2] - L Williams et al, IJOM 44: 599-608 (2015)
[3] - J.R. Moronez et al, Sci Trans. Med 5: 190ra81 (2013)

How might metal 3D printing help?

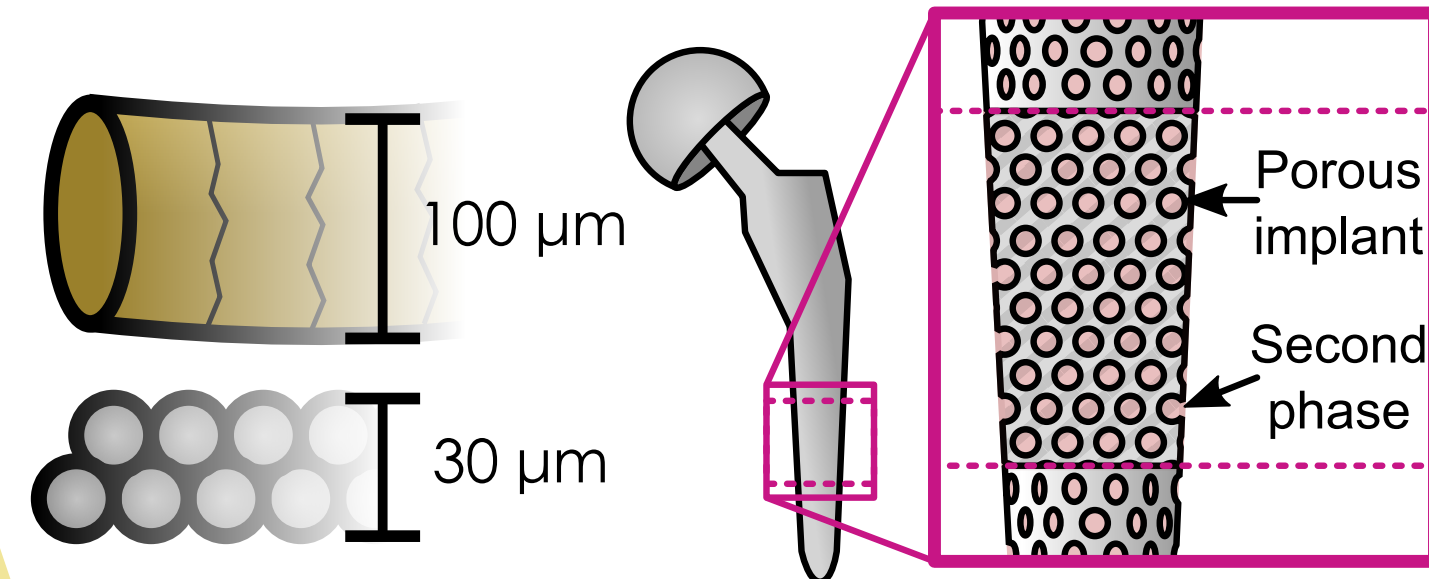
By **selective laser melting** from a powder feedstock, we can create entirely new alloys just by **mixing metal powders**. We use this to integrate silver, an antimicrobial metal



Ti-6Al-4V

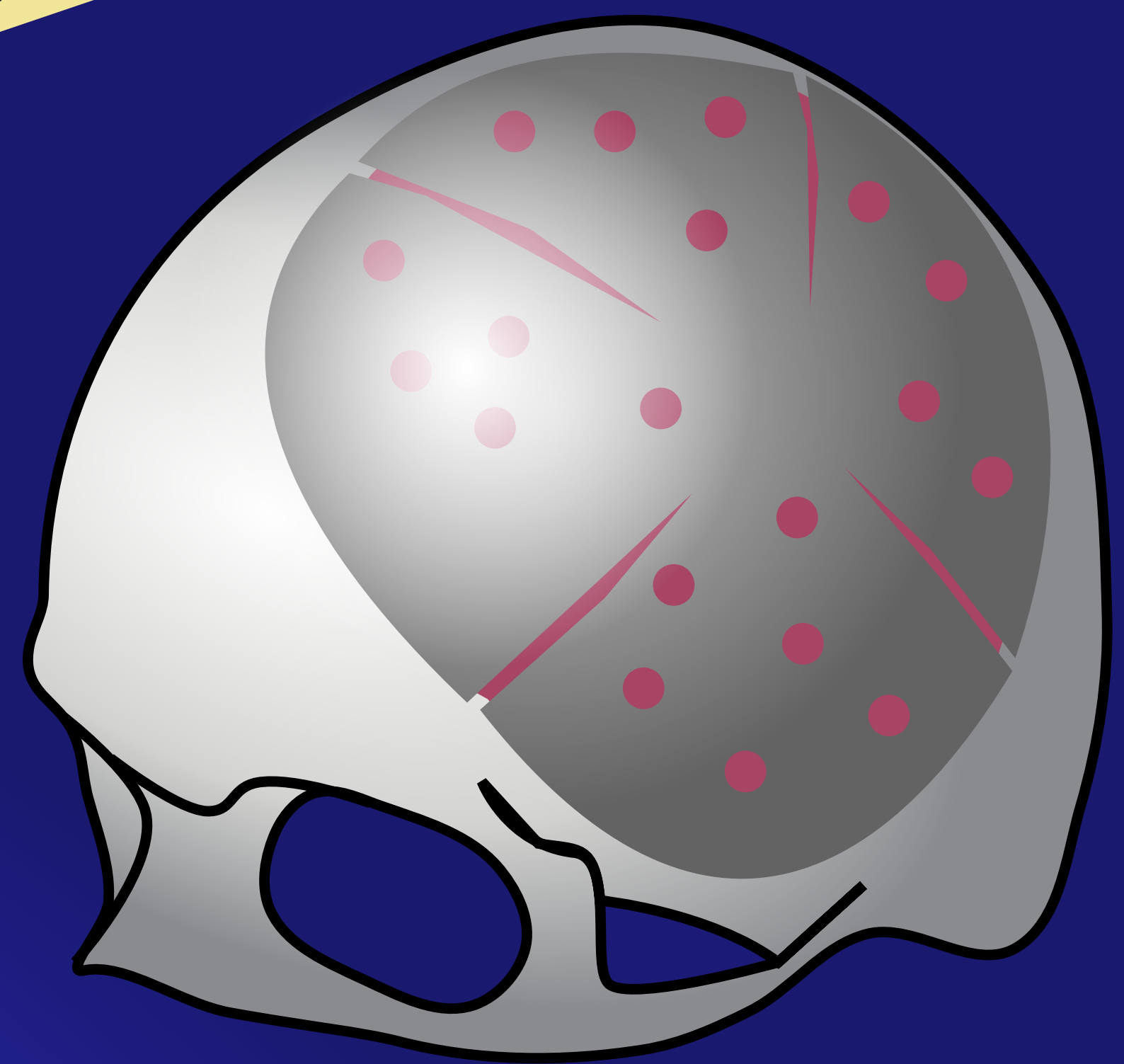
Ag

The technique builds up layers **thinner than a human hair**. This lets us create complex hollow implants we can fill with antimicrobial cements



(See Sophie Louth's poster for more about this!)

3D printing offers new ways to safeguard implants against infection using silver



We are developing new alloys to prevent bacteria gaining a foothold, and cements that naturally degrade in the body to release bacteria-fighting ions



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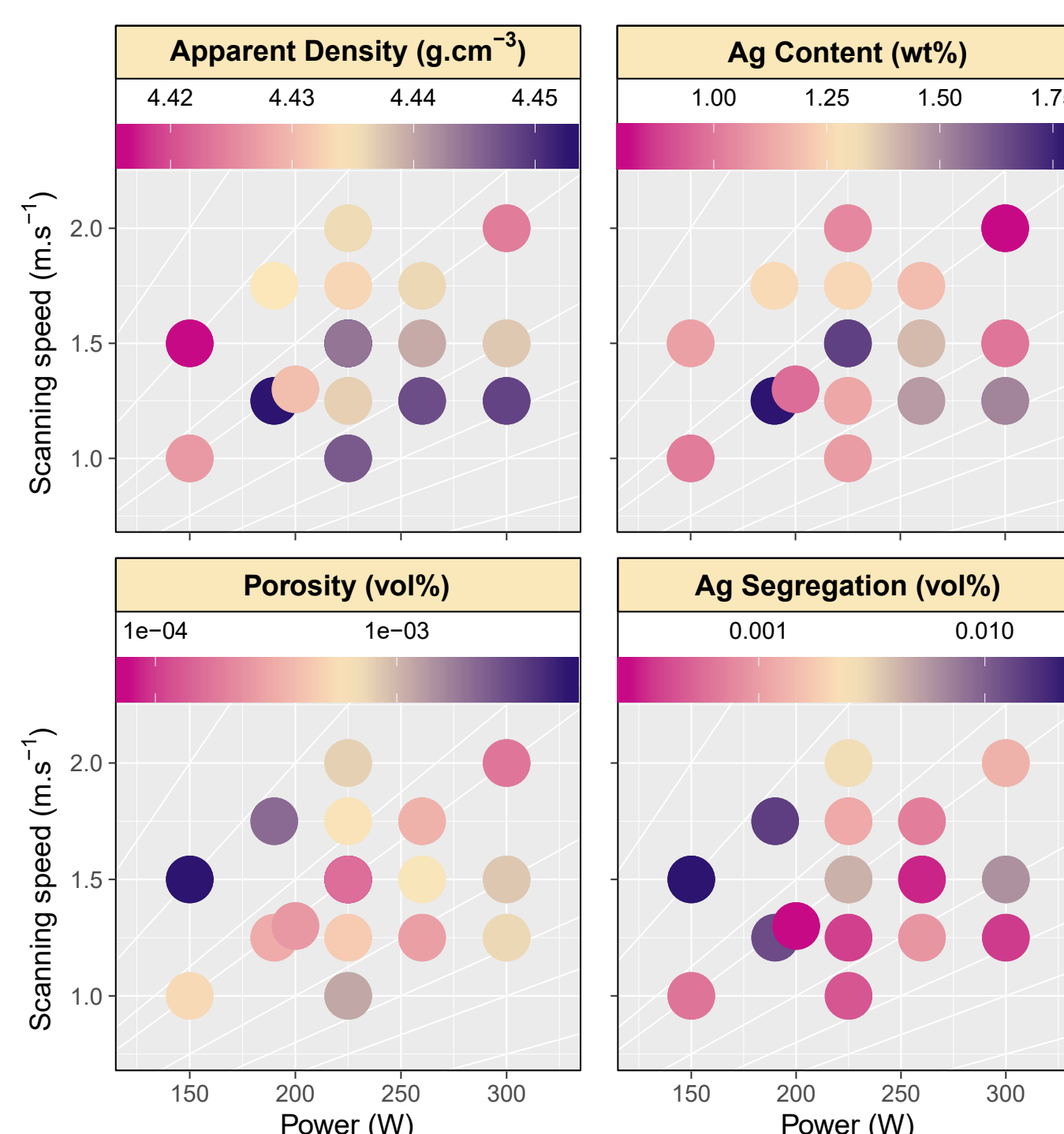


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Melting metals

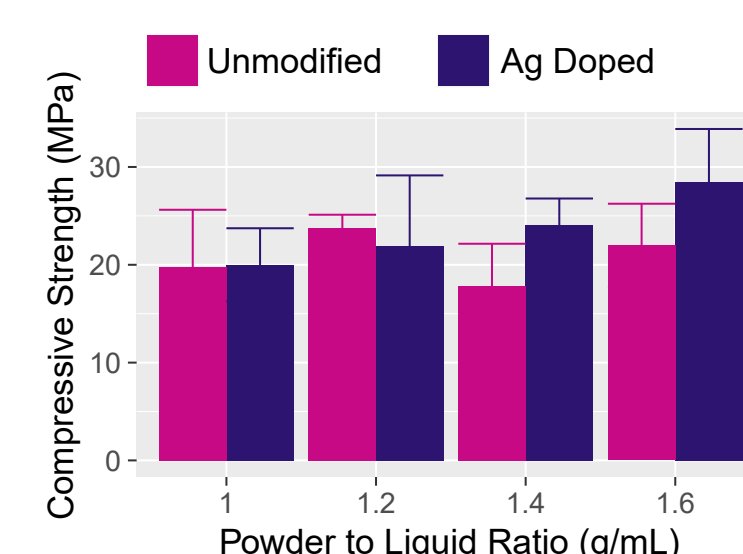
To make material reliably, **validation of the melting** process is key. Density is a measure of how effectively we melt and fuse powders, but we also track silver content, as it gets hot enough to **boil silver**

Taking our alloy, we expose it to bacterial cultures, check it **disrupts biofilm formation**, and makes life that bit harder for infections like e. coli or staph. aureus



Old cements | new tricks

Magnesium oxychloride cement (MOC) has uses in construction but **degrades in contact with water** - allowing it to break down *in vivo*



Addition of silver phosphate allows **Ag⁺ ion release** as cements degrade, without weakening the cement when dry

These new formulations **change colour** as they cure, crucial for surgeons to check it is setting correctly during surgery

