ToffeeX, Imperial College London, and University of Wolverhampton Revolutionise Heat Sink Design with Advanced 3D Printing in Copper

LONDON, 12 December 2024 — ToffeeX, in collaboration with Imperial College London and the University of Wolverhampton, has pioneered a design framework that brings multiscale analysis to physics-driven design. At the point of use, this method fully captures thermo-fluid behaviour without resorting to CFD. Today, the University of Wolverhampton has manufactured the first ever test specimen created with this method.

Multiscale modelling offers a computationally efficient solution to the challenges posed by traditional CFD. It models complex systems by solving a series of decoupled smaller systems, which are then assembled to accurately replicate the full behaviour. The decoupling dramatically reduces computation time while maintaining high resolution.

In parallel, the University of Wolverhampton has utilised its world-leading EOS M290 Laser-Powder Bed Fusion (L-PBF) technology, deploying a 400W laser to manufacture these designs in high purity copper. Known for its high thermal conductivity, copper has traditionally presented challenges in 3D printing due to its reflective properties. However, this partnership has overcome those obstacles, producing copper heat sinks with enhanced precision and durability, showcasing the potential of L-PBF technologies.

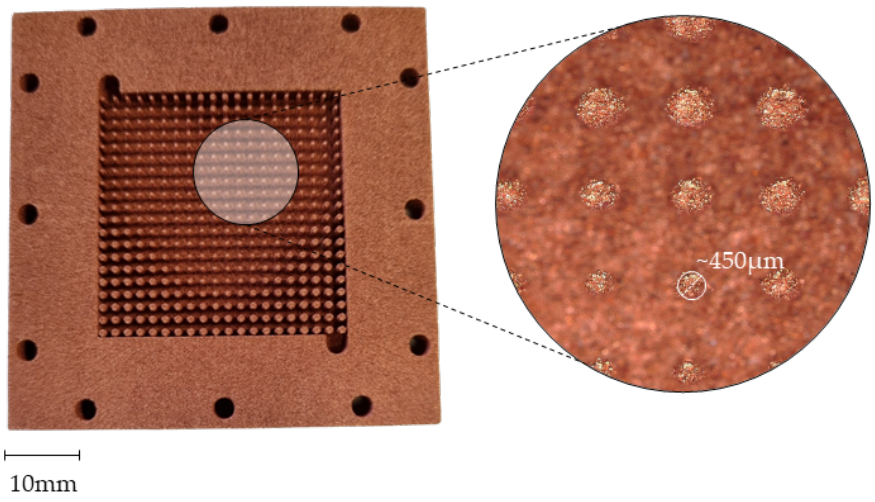

Figure 1: 3D printed component demonstrating grading of pillars which can be used to balance heat transfer and pressure loss of the system.

Professor Arun Arjunan, director of the university's Elite Centre for Manufacturing Skills (ECMS) and Centre for Engineering Innovation and Research (CEIR) said: "Working with ToffeeX, and Imperial College London pushing the boundaries of L-PBF copper printing and heat sink design highlights the potential of additive manufacturing and thermal management. By combining our expertise in advanced materials and 3D printing technologies, we will continue to develop innovative solutions that meet the growing demand for efficient thermal management systems across various industries."

This collaboration marks a significant step forward in both additive manufacturing, multiscale modelling and has a promising future for heat sink design, highlighting the power of interdisciplinary teamwork to expand technological boundaries. ToffeeX, Imperial College London, and the University of Wolverhampton look forward to further innovations in their pursuit of efficient, sustainable engineering solutions.

About University of Wolverhampton

The University of Wolverhampton's AM experience and history spans over two decades. The University was the first UK institution to install a laser-based AM machine circa 1999, and since then has been at the forefront of metal AM development. Recently the University's additive manufacturing of functional materials (AMFM) research group and spin out Additive Analytics has capitalised on this experience and knowhow developing proprietary data driven laser powder bed fusion parameters enabling 3D printable anti-Covid materials, high purity copper and silver and winning the 2022 Emerald Literati Award.

About Imperial College

The metamaterials research group in the Department of Aeronautics is led by Prof Rob Hewson and Prof Matthew Santer. The group has expertise in designing metamaterials for structural, vibration, thermal and fluidic applications. This active area of research allows the team to design structures for a range of applications using formal optimisation methodologies. Examples of previous research activity includes the design of lightweight structures with vibration responses which can avoid key frequencies or modes, and the design of shells and morphing structures which deform in a prescribed way to external loading.

About ToffeeX

ToffeeX is the leader in physics-driven generative design. Their AI-powered software uses physics to guide the design process, empowering engineers to create optimized products that meet all their requirements in a matter of hours. ToffeeX is used by the world's leading engineering organizations to accelerate their path to sustainability and is at the forefront of innovation in additive and traditional manufacturing processes.

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