Additive Manufacturing for Thermal Management Devices

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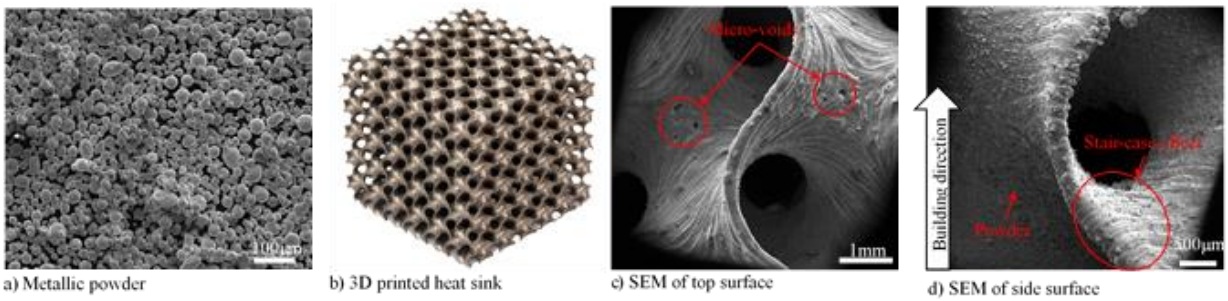
Additive Manufacturing (AM or 3D Printing) refers to the process of building components layer by layer in an additive manner where each layer is bonded to the previous one. AM techniques have gained interest due to their capability of synthesizing complex geometries, functional integration, customization, and cost-effective fabrication of new components for flow and heat transfer applications. However, the different processes have their own limitations and can introduce process-related defects and drawbacks that can affect the performance of thermal management devices (Figure *1*). This talk aims to (1) review the currently used AM techniques to produce thermal management devices, (2) address the limitations of these techniques and the impact they have on the overall device performance, and (3) propose new hybrid techniques that can overcome the limitations and shortcomings of the currently used techniques.



a) Metallic powder b) 3D printed heat sink c) SEM of top surface d) SEM of side surface

Figure 1: Example of a 3D printed heat sink using powder bed fusion AM technique and SEM images of internal defects.

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Dr. Al-Ketan is currently leading the Advanced Manufacturing Core within the Core Technology Platform at New York University, Abu Dhabi (NYUAD). His research focuses on investigating the interrelationship between materials, geometrical features, fabrication process, and mechanical properties of additively manufactured lattices and composites using different materials, fabrication techniques, and length scales. Also, Dr. Al-Ketan's research focuses on the application of additive manufacturing in different engineering disciplines. Prior to joining NYUAD, Dr. Al-Ketan worked as a Post-Doctoral Fellow at Khalifa University of Science and Technology Abu Dhabi, UAE, from which he also received his Ph.D. degree in Interdisciplinary Engineering with a focus on Additive Manufacturing. In 2021 and 2022, Dr. Al-Ketan was ranked among 'Stanford's top 2% world scientists for Single year citations' category.

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