Department of Materials Science and Engineering Seminar Series 2026

Property- and architecture-driven designs for additively manufactured alloys in structural and functional applications

Wei Zhicheng

Date and time: 13th November 2026 (Friday), 2:00 PM

Venue: SDE3-SR7

Abstract

Metal additive manufacturing (AM) offers unprecedented opportunities to tailor material compositions, microstructures, and complex architectures for advanced structural and functional applications. However, achieving reliable mechanical performance under elevated temperatures and optimizing functionality through architectural design remain significant challenges.

This thesis explores property- and architecture-driven design strategies for additively manufactured metallic materials, focusing on four key applications. First, composition and microstructure engineering are employed to mitigate intermediate-temperature brittleness in laser powder bed fusion (LPBF) processed Ni-based multi-component alloys. Through Co alloying, brittle intermetallic precipitates are transformed into coherent $L1_2$ precipitates, significantly improving the strength–ductility balance at elevated temperatures. Second, the high-temperature creep behavior of LPBF-processed Ni-rich multi-component alloys is investigated, demonstrating the role of $L1_2$ precipitates and MC carbides in strengthening and microstructural stability at 900 °C. Third, architected 316L stainless steel structures are developed to enhance sound absorption and mechanical energy absorption through geometric optimization. Finally, additively manufactured NiFeZr-based porous electrodes are investigated for efficient and durable oxygen evolution reactions, highlighting the benefits of architectural design for electrochemical applications.

Collectively, this research demonstrates how the integration of alloy composition, microstructural control, and architectural design can expand the capabilities of metal AM, providing insights into the development of high-performance structural and functional metallic materials.

Biography

Wei Zhicheng is a PhD candidate in the Department of Materials Science and Engineering at the National University of Singapore, under the supervision of Professor Ding Jun. He received his Bachelor's degree from Shenyang Aerospace University and his Master's degree from Shandong University. His research focuses on metal additive manufacturing, alloy design, microstructure engineering, and the development of advanced structural and functional metallic materials.

Please join us!

HOST: Asst. Prof Zhao Ming