Engineering NiTi Alloys for Biomedical Applications: Advances in Metal Injection Moulding and Additive Manufacturing

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Keynote Speaker

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Short Biography

Prof. Dr. Muhammad Hussain Ismail is currently the Director of Industry & Government Network Centre, Department of Industry, Community and Alumni Network Centre (ICAN), Universiti Teknologi MARA. He is also a Professor of Mechanical Engineering at the Universiti Teknologi MARA. He holds a B.Eng. and an MSc in Mechanical & Materials from Universiti Kebangsaan Malaysia, and PhD in Materials Science & Engineering from the University of Sheffield, United Kingdom. His specific research interests are in materials processing, powder metallurgy, additive manufacturing, porous bio-metallic with applications to biomedical implants and devices. To date, he has supervised over 30 graduate students (of which 15 are PhDs) in the area of Materials Processing and Mechanical Engineering. He has successfully secured more than 30 research grants, amounting to approximately RM3 million, throughout his career at UiTM. He has authored over 100 publications, including journal articles and conference proceedings, at both national and international levels. Prof. Hussain also holds four patents and one utility innovation, primarily in the field of materials processing.

Title

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Abstract

Nickel-titanium (NiTi) alloys, renowned for their unique shape memory effect and superelasticity, have emerged as transformative materials in the biomedical sector, particularly for implants and minimally invasive devices. This presentation highlights the advancement and optimization of NiTi alloys through cutting-edge powder metallurgy techniques, specifically metal injection moulding (MIM) and additive manufacturing (AM). These processes enable the fabrication of complex, high-precision components while offering advantages in cost-effectiveness and minimal material waste : key factors in biomedical device production. Despite the challenges associated with processing NiTi, such as achieving precise phase control and minimizing contamination, both MIM and AM present innovative pathways to tailor microstructure and functional properties. The resulting components exhibit excellent biocompatibility, corrosion resistance, and mechanical performance, aligning well with the dynamic requirements of bone, cardiovascular, and dental implants.

This presentation will further examine the process–structure–property relationships governing NiTi components produced by MIM and AM, offering critical insights into how these technologies are driving the next generation of smart, responsive biomedical implants and devices.