Hybridisation of Microstructures by Selective Laser Melting - a New Strategy for Future Alloys

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Nature is full of hybrid structures, as a result of long evolution, which are capable of sophisticated functions. It is, however, difficult to realise in metals. Among conventional engineering alloys, steels, in particular the advanced high strength steels (AHSS), come close with their comprehensive mechanisms including deformation induced transformations and twinning. In the case of metal matrix composites, the constituent phases often have very different strengths, preventing effective coordination between them. We have pioneered a new strategy for producing future alloys with significantly enhanced performances through the hybridisation of different microstructures from existing alloys to generate a composite of "microstructures" rather than phases. By selecting proper ingredient alloys and their associated microstructures in the case of mechanical applications, deformation can be effectively transferred between them, leading to coordinated behaviour of the resulting hybrid material. In this presentation, the new strategy is demonstrated by a hybrid Ti from two existing alloys produced by selective laser melting, leading to superior tensile properties. Further, individual properties can be selectively tailored, giving rise to great flexibility. This novel approach can be applied to a vast variety of metals beyond Ti, leading to unlimited choices, and contributes significantly to the coming era of microstructure-by-design.

Biography

Prof. Kenong Xia received his Ph.D. from University of Southern California in 1988, after B.E. (1982) and M.E. (1984) from Northeastern University in China. He joined Comalco Research Centre in 1988 before starting his academic career at University of Melbourne in 1993. He is currently Professor of Materials in the Department of Mechanical Engineering. A total of over A$9.5 m has been granted by the Australian Research Council and other government bodies and by industry contracts. He is currently a Chief Investigator and Node Coordinator in the Defence Materials Technology Centre, and a Chief Investigator in the ARC Training Centre for Medical Implant Technologies. His current research interests include complex nanostructured alloys and composites, powder consolidation by severe plastic deformation, materials in severe environments, and alloy design for additive manufacturing. In addition to fundamental research, he has carried out significant application-oriented research with funding from industry and non-ARC sources for the automotive and defence industries, focusing on waste-utilisation, metal recycling, energy saving and light-weight applications. He currently serves on the Editorial Board for *Materials Science & Engineering A*.