

# **Progress in Novel Titanium Powder Processes for Additive Manufacturing**

L. Prentice, S. Gulizia, K. McGregor, D. Jewell, and C. Doblin  
Metal Industries Research Program  
CSIRO Manufacturing  
E-mail: [leon.prentice@csiro.au](mailto:leon.prentice@csiro.au)

The metallic additive manufacturing (AM) community has an ongoing need for high-quality but low-cost powder (or wire), particularly of titanium and its alloys. Novel titanium production processes for AM seek to bypass key elements of traditional powder manufacturing, replacing one or more of the Kroll process, melt- and vacuum-refinement, alloying, forming, and atomization/spheroidisation. While many of these 'unconventional' routes have been disclosed for some time, progress to market has been slow and no convincing game-changer has yet emerged.

This review of recent developments and current status will focus on processes and chemistries designed to produce metal powders and/or structures with the most direct manufacturing methods. It will cover advances presented or patented by the key players in Australia, the United States, China, the United Kingdom, South Africa, and other countries, and provide an assessment of the technology status and time to market for the various technologies.

Key issues that hold back the introduction of new technologies will also be discussed, and approaches to mitigate these. They include process control and homogeneity; sizing, morphology, and spheroidisation; quality assurance and certification; and underlying economics and technology viability. Opportunities for the introduction of these materials into the marketplace, initially in low-cost applications, will be highlighted, as well as the path towards high-value applications.