

## Accepted Manuscript

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PII: S0924-0136(17)30555-1  
DOI: <https://doi.org/10.1016/j.jmatprotec.2017.11.035>  
Reference: PROTEC 15509

To appear in: *Journal of Materials Processing Technology*

Received date: 27-4-2017  
Revised date: 16-11-2017  
Accepted date: 18-11-2017

Please cite this article as: Calvert, Emma, Wynne, Brad, Weston, Nick, Tudball, Adam, Jackson, Martin, Thermomechanical processing of a high strength metastable beta titanium alloy powder, consolidated using the low-cost FAST-*forge* process. *Journal of Materials Processing Technology* <https://doi.org/10.1016/j.jmatprotec.2017.11.035>

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# Thermomechanical processing of a high strength metastable beta titanium alloy powder, consolidated using the low-cost FAST-*forge* process

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## Abstract

The high strength titanium alloy Ti-5553 has been fully consolidated and thermomechanically processed from powder using the FAST-*forge* process, in only three steps, both at the small and the pilot scale. Titanium alloy components are conventionally produced using a time-consuming process, which involves carbo-chlorination extraction of TiO<sub>2</sub>, triple vacuum arc re-melting, and multiple thermomechanical and heat treatment steps, before machining. The proposed FAST-*forge* processing route for titanium alloy components cuts out or significantly reduces these stages, and uses field-assisted sintering technology (FAST) to consolidate powder. This paper assesses the effectiveness of the process for a conventionally used high-strength beta titanium alloy, Ti-5553. Ti-5553 has been fully consolidated by the FAST process at two different dwell temperatures, 850 and 1000°C, and for a 30 minute dwell time. Small-scale upset forging of cylinders machined from each FAST condition has been performed at forging temperatures 785, 810 and 835°C, and strain rates 0.01, 0.1, 1 and 5 s<sup>-1</sup>, in order to examine the flow stress behaviour. The flow behaviour of both FAST-produced Ti-5553 specimens was found to be very similar to conventionally produced Ti-5553, and the forged microstructures were also comparable. Large-scale forging

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