Tech Science Press

ICCES, 2024, vol.31, no.2
DOI: 10.32604/icces.2024.013220

PROCEEDINGS

High-Rate Multiaxial Behaviour of Electron Beam Melted Ti-6Al-2Sn-4Zr-2Mo: An Experimental Study Using a Novel Tension-Torsion Hopkinson Bar Apparatus

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ABSTRACT

The dynamic behaviour of Ti-6Al-2Sn-4Zr-2Mo additively manufactured by electron beam melting (EBM) is presented in this study considering synchronised tension-torsion loading. A bespoke spilt Hopkinson Tension-Torsion bar is used to generate combined tensile and torsional stress pulses that interact simultaneously with a novel specimen geometry. High-speed digital imaging correlation techniques are employed to assess the high-rate deformation and crack propagation of the specimen. The material's dynamic response was analysed across a spectrum of stress states, including uniaxial tension, shear, and combinations of tension and shear at strain rates ranging between 500 s^{-1} and 2000 s^{-1}. Comparable failure envelopes of EBM and conventionally manufactured Ti-6Al-2Sn-4Zr-2Mo are presented for the first time, in both quasi-static and dynamic conditions. Results show significant strain rate sensitivity and moderate tension-compression asymmetry. Further scanning electron micrography of the failure surfaces of tested samples indicates the influence of manufacturing defects, stress state, and loading rate on deformation and failure mechanism.

KEYWORDS

Electron beam melting (EBM); Ti-6Al-2Sn-4Zr-2Mo (Ti-6242); tension-torsion; Hopkinson bar; rate dependence

Funding Statement: The authors received no specific funding for this study.

Conflicts of Interest: The authors declare that they have no conflicts of interest to report regarding the present study.