ICSMA19 Metz, France, June 26 - July 1, 2022
International Conference on Strength of Materials

Influence of microstructure on the room and high temperature quasi-static and dynamic deformation behavior of Ti-6Al-4V alloy

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Ti-6Al-4V (Ti-64) alloy, a near α-(α+β) alloy, finds applications in aerospace and military industries for its excellent properties such as high specific strength, excellent corrosion resistance, etc. The reason behind its extensive use is the scope of microstructure modification by various thermomechanical treatments which further improves the mechanical properties. The structural parts made of this alloy are frequently exposed to dynamic loading conditions at elevated temperature (≈ 350°C). Several researchers have investigated both quasi-static and dynamic deformation behavior of the alloy at various temperatures [1,2]. However, a thorough investigation of the effect of different microstructures such as equiaxed, lamellar and bimodal on the mechanical properties is scarce. The present study addresses the quasi-static and dynamic deformation of Ti-64 alloy at different temperatures and strain rates in the range of RT – 450°C and 10^{-3} – 10^{2} s^{-1} respectively. The as-received (hot rolled) material was subjected to different heat treatments (α/β- and β-treatment) to generate three different microstructures with varying phase fraction and phase dimension. Room temperature (RT) uniaxial tensile test and uniaxial hot compression test (RT – 450°C) at varying strain rates were carried out. Microstructural characterization was carried out using EBSD, TEM and XRD bulk texture to understand deformation and failure mechanisms for different testing and microstructural conditions.

Keywords: Ti-6Al-4V, Quasi-static and dynamic deformation, Uniaxial tensile test, Hot compression test

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