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A Slip Transmission through Alpha/Beta Boundaries in a Titanium Alloy (Ti-6Al-4V)

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Abstract : Single alpha-beta colony micro-pillars have been manufactured from a polycrystalline commercial Ti-6Al-4V sample using Focused Ion Beam (FIB). Each pillar contained two alpha lamellae separated by a thin fillet of beta phase. A nano-indenter was then used to conduct uniaxial micro-compression tests on Ti alloy single crystals, using a diamond flat tip as a compression platen. By controlling the crystal orientation along the micro-pillar using Electron back scattering diffraction (EBSD) different slip systems have been selectively activated. The advantage of the micro-compression method over conventional mechanical testing techniques is the ability to localize a single crystal volume which is characterizable after deformation. By matching the stress-strain relations resulting from micro-compression experiments to TEM (Transmission Electron Microscopy) studies of slip transmission mechanisms through the α-β interfaces, some proper constitutive material parameters such as the role of these interfaces in determining yield, strain-hardening behaviour, initial dislocation density and the critical resolved shear stress are suggested.

Keywords : α/β-Ti alloy, focused ion beam, micro-mechanical test, nano-indentation, transmission electron diffraction, plastic flow
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