A new deformation mechanism? In situ investigation of micromechanics of titanium alloys at the ESRF

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Gum metal, Ti-36Nb-2Ta-3Zr-0.3O (wt.%), is a low modulus, high strength, ductile *bcc* titanium alloy that can sustain large elastic deformation prior to yield (~2.5% elastic strain). After yielding this material can withstand significant plastic deformation, reportedly without the aid of dislocation glide. It is suggested that the ideal shear strength of this alloy is comparable with the actual strength, implying that plastic deformation can occur by ideal shear. The single crystal elastic constants have been obtained with the aid of *in-situ* synchrotron X-ray diffraction. The results indicate that (C11 – C12) is approximately 33 GPa in this alloy, which is larger than previously predicted. X-ray diffraction analysis and TEM also suggests that Gum metal undergoes a stress-induced phase transformation during tensile loading. In addition, recent diffraction loading measurements of ours on Ti-6Al-4V, Ti834 and Ti-10-2-3 are reviewed, and broad conclusions drawn about the micromechanics of the spectrum of titanium alloys from near-alpha to fully beta stabilised.