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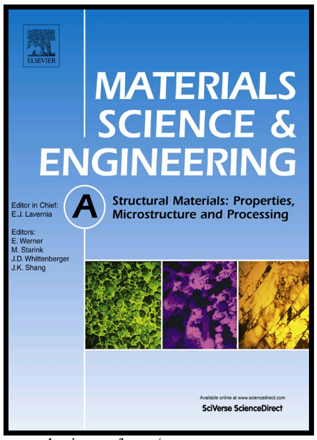

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Understanding the deformation mechanism of individual phases of a dual-phase beta type titanium alloy using *in situ* diffraction method

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ABSTRACT

An *in situ* tensile X-ray diffraction (XRD) set-up with an area detector was employed to characterize deformation behaviors of individual phases in a commercial dual-phase β-Ti alloy. A developed analytical approach based on the modified Williamson-Hall plot accounting for dislocation evolution was proposed to elucidate the deformation mechanism of each phase from the *in situ* XRD data. A commercial purity titanium (alpha type, α-Ti) alloy was examined as a comparison to assist identifying the influence of inter-phase interaction on the deformation behavior of the β-Ti alloy. We found that the small amount of the fine lamella shaped hcp (α) precipitates, which is only 5% in volume, has great effects on the deformation mechanism of the bcc (β) matrix in the β-Ti alloy due to the Burger's orientation relationship (BOR) between the two phases. Due to the reason that slip on the coherent plane of $(211)_\beta$ of the β phase (*i.e.* $(10\bar{1}0)_\alpha$ plane of the α phase) is more predominant than that of $(110)_\beta$ plane (*i.e.* $(0002)_\alpha$ plane) in a hcp ploycrystal, slip on $(211)_\beta$ plane is easier than that on $(110)_\beta$ plane in the β-Ti alloy (cf. {110}<111> is the typical slip system in single phase bcc polycrystals). Although slip on $(211)_\beta$ plane is the most facile, lattice strain on $(211)_\beta$