

Correlations between Microstructure and Fracture Morphologies in Ti-6Al-4V

K N Chaithanya Kumar^a, K. S. Suresh

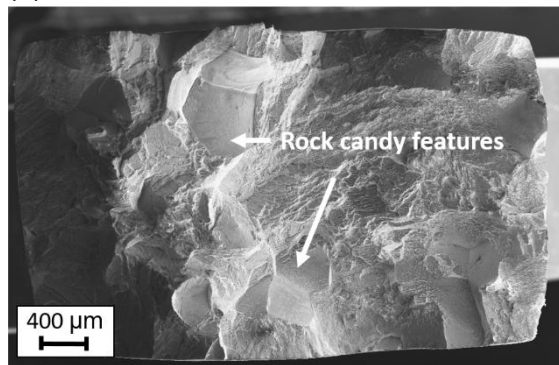
*Department of Materials and Metallurgical Engineering, Indian Institute of Technology Roorkee,
Uttarakhand 247667. India*

^atonagachaithanya@gmail.com

Ti-6Al-4V alloys are the most widely used high specific strength materials. The present study reports the fracture behavior during room temperature uniaxial tensile deformation of Ti-6Al-4V materials having lamellar, martensite, and a combination of martensite with equi-axed grains. Lamellar microstructure shows cleavage fracture while the martensitic microstructure shows cleavage fracture with shallow dimples on the fracture surface indicating significant contributions from the martensite phase towards plasticity. Martensite with fine decomposition of beta exhibited a rock candy appearance suggesting an inter-granular fracture with chevron markings in few grains as in Fig.1a. Inhomogeneous distribution of beta phase could be a possible origin. Material having alpha and martensite microstructure shows no such features and fracture surface appears as quasi-cleavage involving both microvoid coalescence and cleavage as in Fig.1b. Cross sectional EBSD analysis reveals significant orientation gradient in some of the martensite laths in addition to equi-axed alpha indicating the possible slip activity within them.

Keywords: *Ti-6Al-4V; martensite; fractography; EBSD;*

(a) Ti-6Al-4V-martensite with fine beta decomposition



(b) Ti-6Al-4V-(martensite + alpha) with fine beta decomposition

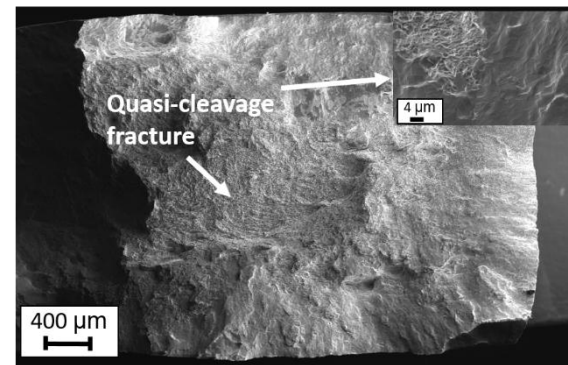


Fig.1 Fracture surface of the (a) martensite and (b) martensite with alpha phase materials

Acknowledgment: The financial support under the Scheme for Promotion of Academic and Research Collaboration (SPARC), MHRD, Government of India (Grant No: SPARC/2018-2019/P1004/SL) is greatly acknowledged.