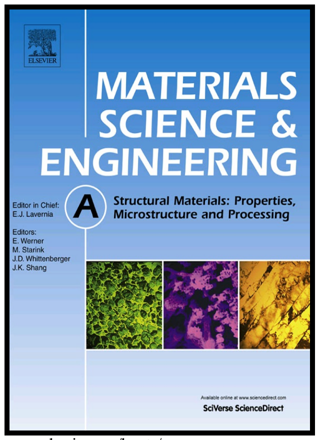

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PII: S0921-5093(17)31129-2
DOI: http://dx.doi.org/10.1016/j.msea.2017.08.097
Reference: MSA35445

To appear in: *Materials Science & Engineering A*

Received date: 30 June 2017
Revised date: 26 August 2017
Accepted date: 28 August 2017

Cite this article as: I. Balasundar and T. Raghu, Experimental and numerical investigation on the tensile properties of a titanium alloy disc with dual microstructure, *Materials Science & Engineering A*, http://dx.doi.org/10.1016/j.msea.2017.08.097

# Experimental and numerical investigation on the tensile properties of a titanium alloy disc with dual microstructure

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**Abstract**

Titanium alloys are used extensively as compressor discs in aero engines. The operating condition of an engine demands better tensile strength and fatigue resistance at the center or bore region of a disc while better creep resistance, fracture toughness and lower crack growth rate are required at the rim. To meet the aforementioned location specific properties, a dual microstructure near α titanium alloy disc with an equiaxed microstructure at the center and fully transformed β microstructure at the rim has been produced using a differential heat treatment process. Varying the microstructures at bore and rim of an integral component results in a transition region where the microstructure varies drastically from one location to another. No systematic study has been reported so far either on the effect transition region or on the effect of varying microstructural constituents on the mechanical properties. An attempt has been made here to provide this essential information which is required to decide the location of transition region or the proportion of varying microstructural constituents while producing dual microstructure discs for aeroengine application. The room temperature tensile property of dual microstructure disc has been evaluated experimentally by varying the microstructural proportion across the tensile sample cross-section or gage length. Further, to gain better insight on the tensile behaviour of dual microstructure samples, three different numerical approaches were investigated to identify a suitable one. Using the identified numerical procedure, the strength of dual microstructure sample with varying microstructural constituents across the sample gage length has been predicted and compared with the experimental results. The results obtained are presented and discussed here.

**Keywords:** Titanium; IMI 834; Dual Microstructure, Tensile test; FEA

## 1. Introduction

There are numerous instances where the operating conditions of a component demands a different and distinct mechanical property requirements from one location to another within a single component e.g. compressor or turbine disc of an aeroengine [1-5]. The operating conditions in an aeroengine demands better tensile strength and fatigue resistance at center while a better creep resistance, fracture toughness and lower crack growth rate are required at the rim [1-5]. Various methods have been proposed and used to produce