

INDIGENOUS DEVELOPMENT OF TITANIUM COMPRESSOR BLADE FOR TURBOFAN ENGINE

Sanjeev Khatarkar, D. Jaganmohan Rao
Engine Division
Hindustan Aeronautics Limited (HAL)
CV Raman Nagar
Bangalore-560 093, India
Email : sanjeev.khatarkar@hal-india-co.in
jaganmohana@hal-india.co.in

S. K. Jha
Regional Centre for Military
Airworthiness (RCMA) (Engines)
Centre for Military Airworthiness and
Certification (CEMILAC)
CV Raman Nagar
Bangalore-560 093, India

Abstract

The Indigenous development of titanium compressor blade was taken up for turbofan engine for aeronautical applications. This titanium compressor blade is classified as flight safety critical part due to its rotating nature in dynamic load conditions. This blade is made from precision forging in titanium material with strength class of 880-1130 MPa. The material produced in accordance with this specification is melted by the triple VAR process or the cold hearth plus VAR process. The material specification calls for compliance on requirements on a forging lot/heat-treat lot/ingot for metallurgical defects like High Interstitial Defects (HID) "Type I" alpha defects, High-Density Inclusions (HDI), High-alpha defects ("Type II" alpha defect), Beta flecks, Clean shrinkage porosity and Strain-induced porosity. The forging required for compressor blade was developed as per approved test schedule, machined for finished dimensions and assembled and type tested in turbofan engine for its qualification. The titanium compressor blade was cleared for production after successfully completing stipulated qualification requirements. This paper covers the approach toward indigenous development of aero-engine titanium compressor blade forging, machining, assembly and its qualification testing in details.

Keywords: Titanium Compressor Blade, Flight Safety Critical, Qualifications, Clearances