

THE HIGH PRESSURE GAS TURBINE BLADES OF JET ENGINES

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Abstract

The modern turbo-engine is one of the finest examples of engineering ingenuity, complexity and usefulness. The turbo-engine, whether used in land-based power generating equipment or in aircraft propulsion, has had a profound impact on our lives. Increasing air-travel, rising fuel prices, and environmental concerns have all combined to increase the need for more fuel-efficient engines. The blades of the high-pressure turbine are the most severely loaded members in the turbo-engine. The various aspects of these blades are described. First, the major components of a turbo-engine as well as the different types of turbo-engines are briefly described. Then the development of the turbo-engine is placed in its historical perspective. Next, the severity of the blade loading conditions, such as high temperatures, high centrifugal stresses, corrosion, oxidation, sulphidation, foreign object damage, etc., and the resulting failure modes are summarized. Super alloys are the materials of choice for these blades. The incremental improvements in the alloy chemistry are briefly traced. Important developments in the blade manufacture, the different types of blade cooling channels and their machining, thermal barrier coatings to decrease the blade temperature while increasing the Turbine Inlet Temperature (TIT), and future trends are discussed. The future belongs inevitably to advanced ceramics and their composites, with coatings for environmental protection.