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FAILURE INVESTIGATION AND ANALYSIS OF LOCALLY MANUFACTURED TURBINE BLADE

Abstract

This study aims to identify the root cause of a turbine blade failure after only 36 hours of operation and recommends measures to prevent future failures. The analysis involved four samples, including an OEM sample, three fabricated samples with cracks and parts, including a kept sample for failure analysis. Microstructural analysis using Villella's reagent as an etchant, surface morphology, and micro-elemental analysis were conducted using the benchtop SEM & EDS. The hardness of the samples was tested using the Rockwell (HRC) method. The failed blade was made of AISI 422 grade stainless steel. It failed due to chipping that initiated cracks when it was tightly fastened, facilitated by internal stress and intermetallic particles in the microstructure. Instead of turbine blades made of hardened steel, the material was found to be slightly ductile and highly prone to compression before breaking when over-tightened during assembly. Inadequate heat treatment practices caused varied microstructural patterns, including the presence of intermetallic particles and significant hardness differences between the fabricated and OEM samples, leading to internal stress. In order to prevent future failures, there is a requirement to improve quality control measures during the fabrication process, particularly in the aspect of heat treatment practices.Thorough testing and analysis of the material microstructure may also be necessary to identify and eliminate potential sources of internal stress and intermetallic particles. Proper installation and fastening of turbine blades, regular inspection, and maintenance can also help identify early signs of failure and prevent catastrophic failures from occurring.

Keywords

Chipping; Cracks; Failure; Hardness; Microstructural; Turbine Blade