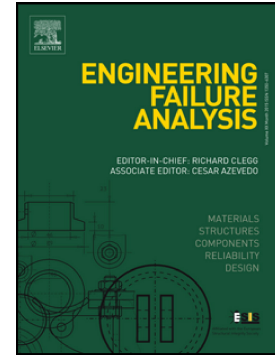


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# DETERMINATION OF THE FRACTURE CAUSE IN AN AIRCRAFT MOTOR CYLINDER

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## Abstract:

One of the six cylinders of an aircraft four-cycle motor was fractured in two pieces between the 13<sup>th</sup>-14<sup>th</sup> cooling fins. To determine the root cause of the fracture, it was necessary a preliminary observation of the whole motor to verify the state of valves, spark plugs, seats, and their disposition in order to determine a possible motor malfunction previous to the failure. Afterwards, a chemical and mechanical material characterization and a fracture surface fractographic study were carried out determining the heat treatment state using metallography and microscopy techniques. Observations of the external and inner cylinder surface were made to detect the possible presence of cracks or pitting. Some pitting were observed in the cylinder external wall. It was determined that material was a quenched and tempered steel, type AISI 4140, and the fracture was brittle presenting fractographic signs of a progressive fracture, concluding that the fracture was originated by a corrosion pit localized in the cylinder external wall that progressed by a fatigue mechanism.

**Keywords:** Aircraft failures; Fatigue failure; Corrosion; Microstructures; Metallurgical failure analysis.

## 1. Introduction

Multiple failures have been reported on this type of four-cycle motor that is the aim of this study. These failures have mainly affected to several critical motor components, such as connecting rods, pistons, crankshafts and cylinders. The most frequent failure mechanisms of this parts are wear or fatigue, but occasionally the failure is originated by the material manufacturing process or an incorrect set up. A fatigue failure occurs suddenly, in contrast to a wearing failure that is avoidable most of the time. This last failure can be detected in advance in oil filters inspections or analyzing the particles that the oil contained by compression tests or boroscopic inspections. The fatigue failure mechanism must be taken account in the early stages of design to guarantee that the

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