FAILURE ANALYSIS OF 17-4 PH STAINLESS STEEL ON CENTRIFUGAL PUMP’S SHAFT IN AMMONIA PLANT PT. PETROKIMIA GRESIK

Name of Student : Galih Nurhadyan
Student ID : 2707 100 025
Department : Materials and Metallurgical Engineering
Faculty of Industrial Technology - ITS
Advisor : Ir. Muchtar Karokaro, M.Sc
          Tubagus Noor Rohmannudin, S.T, M.Sc

Abstract

The failure analysis of the 107-JC pump’s shaft made of stainless steel 17-4 PH series has been done by the metallurgical investigation method. Pump’s shaft has failed on December 19th, 2010 causing the shut down of the pump. It is a centrifugal pumps that drain Semi Lean Benfield Solution (K₂CO₃) liquid that is used in the Ammonia’s production process.

Initial visually observation on a cross sectional area of the fracture shaft indicates that the location of shaft fractures position is below the keyway of the impeller. Furthermore, the investigation had done by a results comparative of a fractograph, photographic, and metallographic examination, identification of the chemical composition, and also mechanical testing that became the base of this analysis scheme. The investigation’s purpose is to determine the factor causing failure on the pump’s shaft.

The result of the investigation it is found a crack in cross-section area of a fracture shaft. The crack originated from the corner of the spie house area (crack initiation), which then form the propagation of cracks and finally fracture entirely on the side of the shaft (the final rupture). So it can be concluded that the mechanism of the fracture is a fatigue fracture.
Record keeping and periodic testing of the condition of the pump shaft by using the method of NDT (Non destructive Test) in the form of ultrasonic testing and liquid penetrant test needs to be done. It is intended to anticipate the indication of component failure, especially on the pump shaft associated with the impeller. It also needs to do some selection and uses of the spie house size that adjusted to the existing standards.

Keyword: stainless steel 17-4 PH, centrifugal pump’s shaft, fatigue fracture, fracture pattern, stress concentration, crack propagation.