REVIEW ON FAILURE ANALYSIS OF HEAVY CONVEYOR CHAIN LINKS

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ABSTRACT

Failure of engineering components due to presence of defects in the material is common. These defects are either present in the material from the manufacturing stage or get developed during subsequent hot working and thermal treatment operations, it may be occurs due to excessive load and environmental conditions. Identification of the origins of defects is an important task while analyzing failures. A case study on failure of conveyor chain links it will be presented in this paper. It will determine that the failure will causes by defects related to the metal processing and working environment.

Keyword: *-Failure Analysis1, Conveyors Chain Links2 etc.*

1. INTRODUCTION

Chains are used in a variety of applications in engineering practice. In general, there are three basic types of system; hoisting and securing chains, conveying and elevating chains and power trans-mission chains. Conveyors chains are used when material are to be moved frequently between specific points. Depending on the materials to be handled and the move to be performed, a variety of conveyors can be used. Conveyors can be categorized on the basis of the type of product being handled (bulk or unit) and the locations of the conveyor (overhead or floor). Bulk materials such as grain, dry chemicals, ores, minerals, coal saw dust, sugarcane, can be conveyed using a belt, and bucket, but due to designing defects, manufacturing defects, operating defects and environment defects conveyor chain links get fails. In this reports we will investigate on metallurgical failure analysis of conveyor chains links used in various industries such as sugarcane cement, automobile and chemical. The investigations will focused on identifying the possible cause of failure by evaluation of chemical analysis, mechanical properties, and microstructure and visual observations of the fractured surfaces.

2. LITERTUER REVIEW

S.G. Sapate, V.K. Didolkar [1] The author has studied metallurgical investigation of fractured connecting pins of chain conveyors used for coal conveying from raw coal hopper to grave gate in coal mill of a cement plant. The failure analysis of two fractured pins was carried out; the location of the fracture was near the end of the pins. Both the failed pins had reduced cross section in the immediate vicinity of the fractured surface. The chemical composition of the pins confirmed to En-19 specifications. The hardness and metallographic studies indicated that the pins were induction hardened at the surface whereas the core of the pins had tempered martensitic microstructure. The visual observations of the failed pins confirmed entrapment of fine to heavy coarse coal particles on the pin surface causing mild to severe polishing wear with subsequent reduction in the cross section.

The metallographic studies showed non-uniformity in the induction hardening and undesirable coarse martensitic microstructure at the core. The analysis of the fractured surface and fractographic studies by SEM indicated fatigue fracture due to bending stresses and mild to moderate torsional stresses. The proper induction hardening to ensure required case depth and use of En-24 steel for connecting pins has been suggested to further improve life of the connecting pins.

M. Sujata, M.A. Venkataswamy, M.A. Parameswara, S.K. Bhaumik[2] The authors has studied Failure of engineering components due to presence of defects in the material. These defects are either present in the material from the casting stage or get developed during subsequent hot working and thermal treatment operations. Systematic failure analysis can identify their origin and thereby corrective measures can be initiated to prevent the recurrence of similar defects in the final products. Case study on failure of conveyor chain links is presented in this paper. It was determined that the failure was caused by defects related to the metal processing. These defects were identified as surface defects in the billet, which got translated into lap or fold like defects in the final products. It was recommended that the billet be properly dressed and the surface defects are removed prior to forging operations.

G.A.Slabbert, J.J.Mcewan and R.Paton [3] The authors has done the analysis of a failure of conveyor chain pins that had operated for only six weeks in sugar plant. The pins had been heat treated so that they had become susceptible to hydrogen embrittlement and had cracked. The source of hydrogen was attributed to corrosion of other steel components in the system. In order to minimize the likelihood of future failures, it was recommended that the source of the corroded components be identified. Addition, it was recommended that the authors should liaise with the plant personnel in order to recommend a suitable heat treatment schedule for future pins.

Edward Yin, Onumus Muvengei, John Kihiu, Kenneth Njoroge [4] The author has studied failure of the chain link of a bucket elevator by carrying out visual examination, chemical analysis and metallurgical analysis on failed chain link samples. Preliminary examination using stereo microscope revealed the type of fracture is a brittle fracture and chevron marks showed that the fracture began from the core of the fractured surface and progressed through the material until eventual fracture occurred. Metallurgical analysis revealed that the micro-structure is a tempered martensite and the material had a lot of cracks embedded within it which propagated during loading. Chemical analysis revealed that the carbon content was below the required standards and therefore does not meet the requirements. It was concluded that the crack had initiated from an inclusion and therefore was the cause of failure.

Nur Ismalina Haris, Md Saidin Wahab, Amarul Talip[5] The author has investigated the causes of failure of chain system through characterization on the failure component. The failures that occur are relate to welding because this dipping latex industry used customized chain that have to be weld in joining with outer chain links. The analysis revealed that the weld defect such as crater leads the crack propagation and added with cyclic loading that cause the fatigue failure. The fatigue failure occurs due to this generated crack at the outer circumference of the weld within chain attachment and outer chain links plate. The investigation is carried out with the help of scanning electron microscopy (SEM) analysis and Hardness testing by using Rockwell Tester. From investigation it was found that stress can be minimized with increasing the plate thickness.

S. Sankar, M. Nataraj, V. Prabhu Raja [6] The author examines the failure of shear pins that connect gearbox and generator in a wind turbine generator. Chemical and micro-structural together with hardness measurements have been performed to check any deviation in the material specification. The failure mechanism is analyzed by both visual and Scanning Electron Microscope (SEM) inspection on the fractured surface. The metallographic and chemical analyses reveal that the failure is not related to any defect in material or with any abnormal operating conditions like temperature. The neck diameter of shear pin is optimized for the safe operation of the wind turbine. It is inferred from the observations based on fractography study on the fractured surface of the shear pins that the misalignment between the driving and the driven elements in the wind turbine leads to low cyclic fatigue growth.

3. METHODOLOGY

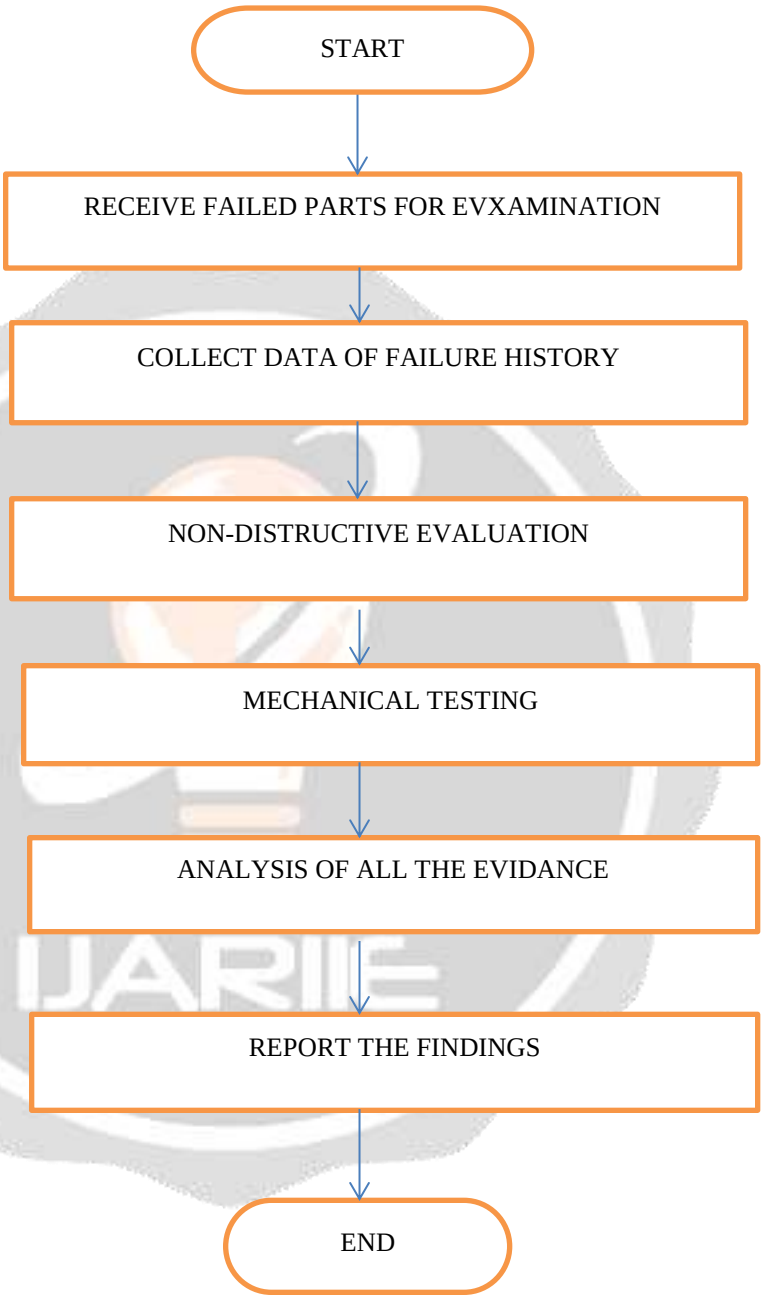

Fig- Methodology

4. CONCLUSIONS

As earlier stated that to know why system fails we need to perform different types of analysis. All the authors from different background they have taken particular cases for the study and evaluated. While investigating the failure of mechanical systems they have gone through analytical as well as experimental approach to conclude the same.

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