Rear axle failure analysis of the dump truck

FA Nugroho, S Nugroho... - Am Sci Res J Eng Technol ..., 2019 - core.ac.uk

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American Academic Scientific Research Journal for Engineering, Technology, and Sciences

Vol. 57 No. 1 (2019)

Published: 2019-07-05

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PDF

Rear Axle Failure Analysis of the Dump Truck

Faizin Adi Nugroho, Sri Nugroho, Mohammad Tauviqirrahman

201-209

PDF

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Oyuntsetseg Sodovjamts, Ambaga Miegombo, Sarantsetseg Bandi, Khishigjargal Ser-Od

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American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS)
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Rear Axle Failure Analysis of the Dump Truck

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Abstract

The dump truck rear axle has failed while operating. The shaft transmits torque from the differential gear to the rear wheels through a planetary gear arrangement. Axle parts that fail to be investigated to determine the cause of failure. Field scanning is done using scanning electron microscopy (SEM). The hardness profile along the cross section is evaluated by measurement of micro hardness. Chemical analysis shows that the shaft is made of american iron steel institude (AISI) 4140 steel. The shaft carbon content is 0.52%, higher than AISI 4140 standard where the maximum carbon content is 0.45%. Manganese (Mn), sulfur (S), phosphorus (P), silicon (Si), and chromium (Cr) content have met standards. Microstructure analysis and profile hardness testing revealed that the edge profile was more fragile, different from the more resilient core. This phenomenon is related to the discovery of microstructure on the edge of the profile found in a martensitic structure which reveals that the manufacturing of the shaft undergoes a surface hardening process to harden the shaft surface. The analysis shows that the fracture starts from the edge of the profile where there is a fragile martensitic structure due to improper heat treatment (high hardness).

Keywords: rear axle; AISI 4140; failure analysis; fatigue.

1. Introduction

One form of failure of an automotive component occurs in a rear axle shaft of a dump truck vehicle. This condition occurs because the wheel shaft stem fails early (premature fracture).

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American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS)
ISSN (Print) 2313-4410, ISSN (Online) 2313-4402

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Performance of Cement Boards in Presence of Waste Paper

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Abstract

The possibility of using waste paper in manufacturing of cement board has been investigated in this paper. Cement fiber ratio and pressure is the two variables in this experimental work. Samples were prepared with fiber/cement ratios of 5:95, 15:85 and 25:75 by weight. Every mixing ratio was divided in seven sub categories depending on the pressure of 0, 1.4, 2.4, 4.2, 5.5 6.9 and 8.3 MPa. Three boards were prepared for each category to evaluate the mechanical and physical properties of the boards according to ASTM standard. It is observed that the mechanical and physical properties of the board are directly influenced with pressure. However, the flexural strength and modulus of rupture were decreased with an increase of the amount of waste paper in the board. Five percent addition of waste paper exhibits the best performance of cement board in all aspect. The optimum production condition was obtained when the fiber content and pressure were 5% and 6.9 MPa respectively. At this optimum condition the prepared cement board satisfies the flexural strength requirement for Grade 2 type cement board according to ASTM C 1186.

Keywords: Waste Paper; Flexural Strength; Modulus of Rupture; Water Content.

1. Introduction

Innovative and environment friendly construction material is a key matter in developing and sustainable issues. Presently a burning issue is the environmental awareness, which involves to the construction industries to produce environment friendly materials. Material from available resources along with waste has environmental benefits, if this is being considered for applications in the building components.

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American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS)
ISSN (Print) 2313-4410, ISSN (Online) 2313-4402

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Five Classifications of Mammography Images Based on Deep Cooperation Convolutional Neural Network

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Abstract

Mammography is currently the preferred imaging method for breast cancer screening. Masses and calcification are the main positive signs of mammography. Due to the variable appearance of masses and calcification, a significant number of breast cancer cases are missed or misdiagnosed if it is only depended on the radiologists' subjective judgement. At present, most of the studies are based on the classical Convolutional Neural Networks (CNN), which uses the transfer learning to classify the benign and malignant masses in the mammography images. However, the CNN is designed for natural images which are substantially different from medical images. Therefore, we propose a Deep Cooperation CNN (DCCNN) to classify mammography images of a data set into five categories including benign calcification, benign mass, malignant calcification, malignant mass and normal breast. The data set consists of 695 normal cases from DDSM, 753 calcification cases and 891 mass cases from CBIS-DDSM. Finally, DCCNN achieves 91% accuracy and 0.98 AUC on the test set, whose performance is superior to VGG16, GoogLeNet and InceptionV3 models. Therefore, DCCNN can aid radiologists to make more accurate judgments, greatly reducing the rate of missed and misdiagnosis.

Keywords: Mammography; Breast cancer screening; CNN; Deep Cooperation CNN.

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