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D.T. Oloruntoba, A.P.I. Popoola

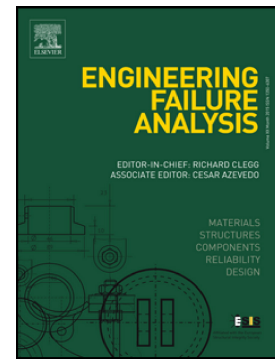
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Investigation of a failed circular sawmill blade structures

Oloruntoba, D. T.^{1,2} and Popoola A. P. I¹

¹Department of Chemical, Metallurgical and Materials Engineering, Tshwane University of Technology, Private Bag X680, Pretoria, South Africa.

²Department of Metallurgical and Materials Engineering, Federal University of Technology, PMB 704, Akure. Nigeria

Correspondence: dtoloruntoba@futa.edu.ng, PopoolaAPI@tut.ac.za +234803 363 6164

Abstract

The engineering materials fracture is an undesirable event due to human lives that could be in jeopardy, economic loss, and the negative interference with the availability of products and services. Sawmill blade performance depends on many factors ranging from the structure of the materials of the blade, applied load, operating conditions and the target body to cut. A sawmill blade cutting tooth must be of high carbide material for longer life span in service. A portion of a failed sawmill blade for cutting wood was examined for chemical composition. The X-ray characterisation was carried out using diffractometer (XRD) and scanning electron microscopy (SEM) for the proper understanding of the blade phase composition and structure. The results obtained were compared with the standard steel blade properties to predict reasons for the failure apart from the torsion effects on the materials. The carbon content of the blade is 0.66% medium carbon steel class. The carbon content of the failed blade was less compared to that of the standard (0.8 % C and above). Carburization treatment was recommended for improvement of the sawmill blade performance based on the material composition. The failure of small-sized component needs prevention to avoid catastrophic destruction and consequently injury or death that may cause expensive lawsuits.

Keywords: sawmill blade; carbide; chemical composition; microstructure; XRD/SEM.

1. Introduction

Circular saw blade is a power-tool that employs a toothed or abrasive disc to cut different materials (wood, masonry, plastic or metal), natural stone, soil and land tillage using a rotary motion spinning around an arbour [1-3]. A circular saw may be hand-held or mouthed to a machine. In woodworking, the term circular saw refers specifically to the hand-held type and the table and chop saws are other common forms of circular saws [4-6]. Circular saw blades are specially designed for each material they are intended to cut. In cutting wood, they are specifically designed for making rip-cuts, cross-cuts, or a combination of both. Circular blade is most powered by either electricity or a hydraulic motor that allows it to be fastened to heavy equipment, eliminating the need for a separate energy source.

Circular blades are usually made from medium carbon steel. Medium carbon steel is used in the production of connecting rod, spring, clips, axles, shift and brake levers, key stock, gear shafts, wire and rods, railway coach axles, shafts crank pins on the heavy machine as well as sawmill blade [7]. Alloy additions are made to optimize the materials properties such as tensile, impact, wear, hardness and corrosion resistances at elevated temperatures. However, this is at the high cost of alloying elements. The need for low alloy medium carbon steel are great, it is, therefore,

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