MICROSTRUCTURAL AND MECHANICAL PROPERTIES OF FAILED COUPLING WITH AN AIRLOCK IN A FLOUR MILL

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ABSTRACT

In the present work, we report the microstructural and mechanical properties of failed coupling with an airlock in a flour mill. The coupling which was made of aluminium alloy is used to transmit torque from the electric motor to an airlock used on a flour mill production line. The fracture that occurred at the root of the teeth of the coupling was investigated using various tests and analysis. The tests includes: macro examination, micro-structural examination, composition analysis, hardness and tensile test were employed for this investigation. From the tests carried out, it was observed from the macro examination that the coupling undergoes a brittle failure. However, composition analysis revealed a relatively high weight composition of aluminium (87.5 wt. %) suggesting that the coupling was made of aluminium based alloy. The significant presence of Cu and Zn at 2.77 wt. % and 1.03 wt. % respectively indicates that the alloying elements were mainly of copper and zinc. The tensile test result revealed that the material has an ultimate tensile strength of 178 N/mm^2 which is comparatively lower than most aluminium alloys. This might be as a result of the high Si composition of 7.24 wt. % observed from the chemical compositional analysis. The hardness result showed the Brinell hardness of the fractured samples as 76.53 BHN. The microstructure of the coupling at three different sections gave three different micrographs, further proving uneven distribution of the aluminium alloy element. Thus, the presence of Si at relatively high percentage, often intended to increase the strength, wear resistance and weldability may be detrimental to the coupling ductility and tensile strength and may have contributed to the early fracture of the coupling.

Key words: coupling, failure analysis, mechanical properties, microstructure.

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