



Review

Failure assessment of the continuous miner cutter sleeves in Coal Mines: A case study



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ABSTRACT

The continuous miner cutter (CMC) sleeve is an integral part of the mining tools, including the bones and picks. It is designed to allow free rotation of the pick in its bore while cutting the coal. It is critical that mining companies understand the nature of damage encountered in CMC's sleeves to develop appropriate mitigation measures for improving its wear resistance and toughness to increase the productivity and profitability of the business. In this study, the failure modes and mechanism of damaged sleeves were analysed by - macroscopic and microscopic failure analyses. The characterisation of the coal seam was also presented. The macroscopic failure modes of the damaged samples were found to be collar fracture, collar wear, and plastic deformation. Of these failure modes, collar fracture occurs most frequently and has the highest weight loss followed by collar wear and then plastic deformation. Fractographic examination by scanning electron microscopy (SEM) equipped with Energy dispersive X-rays spectroscopy (EDS) revealed the presence of voids, roughness, and striation defects in the purchased sleeve, which are due to the manufacturing process. Moreover, the presence of - pits, cracks, abrasive wear, and coal-rock channels was found in the damaged sleeves. EDS spectra revealed coal and rock intermixing. This study established that the steel grade and the manufacturing process used in fabricating the sleeve are not suitable, especially for coal mining. Finally, mitigation measures were offered on the proper selection of materials, manufacturing process, pick redesign, and maintenance approach to improve the performance and durability of the sleeves.

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