THE EFFECT OF CONTAMINANTS IN USED MINING GEAR OILS ON THE WEAR OF MACHINE ELEMENTS WITH THIN ANTIWEAR COATINGS

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ABSTRACT

In spite of long history of the development of the technology of gear manufacturing for mining industry, the producers of drivetrains report various operational demands. One of the main issues is related to minimize severe wear. Such an effect can be achieved by the deposition of a thin, hard, low-friction coating on the tooth flanks of gears. As the gear systems operated in coal mines are exposed to the adverse influence of the oil contaminants coming from the environment, the risk of coating removal due to friction cannot be neglected. The aim of the work was to investigate the action of contaminants in oil on the wear of coated tribosystems.

The oils used in transmissions of mining machines (belt and chain conveyors) operating in 5 coal mines in Poland were obtained for research. The 20 oils denoted as MM-01 to MM-20, came from 6 types of gear systems with different operating times. Firstly, the type of contaminants presented in used oils has been determined. The tests were carried out with the use of the modern analytical techniques (XRF, SEM, EDS) allowing to determine the composition and concentration of contaminants in exploited oils. The tribological properties, i.e. the average wear scar diameter *d* and the limiting pressure of seizure p_{oz} were determined using T-02U four ball apparatus. The specimens were coated with the DLC, low-friction a-C:H:W coating, denoted as: WC/C, deposited by physical vapour deposition (PVD). The coating thickness was about 2 µm.

In the tested oil, there were impurities in the form of particulate matter (rock, coal), water, and products of wear (Fe, Cu), in different proportions. Using contaminated oil, a higher wear of steel elements and lower limiting pressure of seizure were obtained, than for the fresh oil (Figure 1). The application of the coating to the rubbing elements eliminated the negative effects of contaminants.

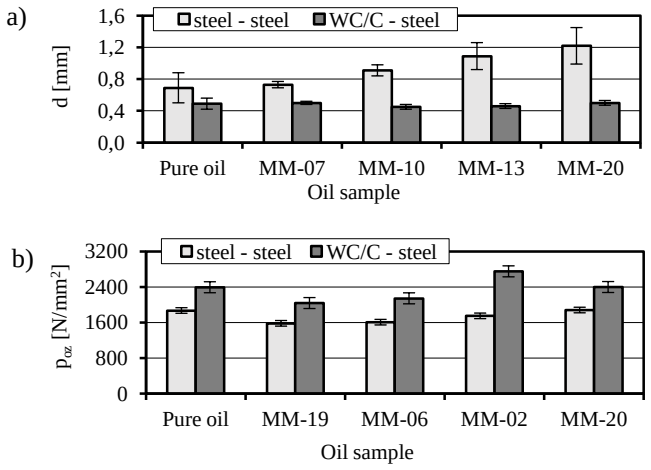

Fig.1 The average wear scar diameter d (a) and limiting pressure of seizure p_{oz} (b) for investigated tribosystems

In conclusion, the tribosystems with the coated elements are more resistant to the negative action of contaminants than friction pairs with uncoated parts. Thus, it is possible to protect the machine parts against wear even if the oil is contaminated, provided that the coating is harder than the solid particles.

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