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Investigation of composite coated Ti-C-N surfaces with ball-cratering test method

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Abstract: We present the performance of dry sliding metal-metal wear performance of AISI SS410 and Ti-C-N coated specimens at room temperature. In this investigation, the ball cratering abrasive wear testing method was used with a various loads of 2N, 3N and 4N, with total sliding distance of 353.43 m and at a constant sliding speed of 0.3927 ms^{-1}. In this testing machine the abrasive ball of high carbon steel with 750 HV at 100 g load is rotated against the Ti-C-N composite coated and uncoated AISI SS410. The worn surfaces were examined with scanning electron microscopy (SEM) (with EDAX attachment). The more grooving region, pits, ploughing ridge were found on the worn surface of the high carbon steel.

Keywords: Friction and wear resistant; TiCN**;** SEM-EDAX; PVD coating

1. Introduction:

In modern internal combustion engines mechanical losses increases due to friction 4 and 15% of the total energy consumed **[1]**. Mechanical losses of about 40% - 55% occur in the power cylinder **[2]**, and the piston ring generated half of the power cylinder friction losses **[1, 3, 4]**. Recent studies show that 80% of the total cost for the protection of metals is related to coating application **[5]**. Deposition of coatings provide a way of extending the limits of the use of the materials and their performance capabilities, by allowing the mechanical properties of the substrate materials to be maintained while protecting against wear, oxidation and corrosion **[6]**. Tribological failure like scuffing failure occurs which is characterized by a sudden rise in friction, contact temperature, vibration and noise, resulting in a surface roughening through severe plastic flow and loss of surface integrity **[7, 8]**. The physical vapour deposition (PVD) techniques are widely used nowadays for improvement of the mechanical, corrosion protection capability and other properties, of a broad range of engineering materials **[9, 10]**. The TiN coating was developed in the early 1970s **[11]** and this hard coating is an important role in surface engineering parts for two decades because of high hardness over 20 GPa **[12]**. As one of the major milestones in the advances of hard coating development, TiAlN has been commercially very successful due to significantly improved oxidation resistance and hardness over TiN **[13-18]**. Use of real engine tests for the evaluation of tribological performance is very costly and time consuming. One way to speed up the process, while maintaining accuracy of the prediction, is to