Tribological Performance of MoS2:Ti/MoS_2: TiBN/TiBN/TiB2/Ti Composites.

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Abstract

Deposition of surface coatings is one of the important approaches in improving the friction and wear properties of surfaces. For instance, self-lubricating coatings such as MoS_2- Ti are advantageous in reducing friction. These self-lubricating coatings outperform liquid lubricants in several applications such as vacuum and high temperatures. Wear resistant coatings such as TiB_2 are important in reducing wear rate of a material. Even though single layer coatings have a wide range of application their tribological performance may not be sufficient. Hence, coatings that consist of different properties can be prepared as multilayer coatings. These coatings can have different sequence of layers depending on the intended application of the material. In this study, the tribological properties of a graded composite multilayer coating with specific sequence of MoS2:Ti/MoS_2:TiBN/TiBN/TiB2/Ti deposited on tool steel substrate was investigated. The coating was deposited by a Closed-Field Unbalanced Magnetron Sputtering technique. The friction and wear properties of the coating were studied at 40°C and 400°C with the help of a high-temperature reciprocating friction and wear tester and wear scars were also analyzed with Scanning Electron Microscope with incorporated Electron Dispersive Spectroscopy. The hardness of the coating was also studied with the help of micro-hardness tester. The experimental results for the tests done at 40°C have shown that the friction coefficient value ranges between 0.02 and 0.034. It has been found that the friction coefficient values were different depending on the deposition parameters used and the coatings deposited at higher substrate bias were found to result in higher friction. The durability of the coating was also found to be dependent on the deposition parameters and the specimen deposited at -150 V substrate bias and 3 % N_2 flow has the lowest durability. The friction coefficient and durability of the coatings were found to be highly dependent on temperature. At high temperature, the friction coefficient increases by three folds and the durability decreases significantly. The SEM images of the wear scars have shown that the wear is an adhesive wear type. The hardness of the tool steel surface was also improved with the deposition of the multilayer coating.