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Friction and wear of TiAlN/a-C:N coatings under variable conditions

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Carbon-based coatings are due to their excellent properties such as high wear resistance and low coefficient of friction often used for tribological applications, especially under conditions of dry friction. In this work we investigated double layer composed from top carbon based coating and TiAlN underlayer. The base layer, which has bearing function, was commonly used coating TiAlN with thickness 3–9 µm. Second layer, which has lubrication function, was a-CN coating with thickness 0.5–1.5 µm. All coatings were prepared by conventional DC magnetron sputtering in CemeCon 800/9 sinOx ML at temperature around 400 °C. The coefficient of friction and wear were analysed using a pin-on-disk instrument, a 3D profilometer and a confocal microscope. The pin-on-disk tests were made in air, in water and in nitrogen environment using linear and rotating mode. Relative velocity of 0.2–50 cm/s and load of 1–20N was applied. As a counterpart body Al2O3 and 100Cr6 balls with 6 mm in diameter were used. Coefficient of friction and wear depend significantly on test conditions. For measurements in air in most cases the coefficient of friction was 0.2 0.3, the coefficient of wear of coating was 100–1000 µm3/Nm and the coefficient of wear of ball was 50–200 µm3/Nm. In nitrogen environment much higher values were observed. The coefficient of friction was 0.2–0.6, the coefficient of wear of coating was 1000–25000 µm3/Nm and the coefficient of wear of ball was 50–60000 µm3/Nm. However, in water the coefficient of friction was ~0.1 with no wear observed even after 20000 cycles (sliding distance ~700 m). This study indicates that a-C:N can be very successfully used to enhance the tribological properties of TiAlN coating. Double layer TiAlN/a C:N offers an excellent lubrication effect and a reliable protection against wear.

Keywords
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