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Comparison of mechanical behavior of TiN, TiNC, CrN/TiNC, TiN/TiNC films on 9Cr18 steel by PVD

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TiN, TiNC, CrN/TiNC and TiN/TiNC films were deposited on 9Cr18 steel using magnetron sputtering technique. The morphology, composition, chemical state and crystalline structure of the films were observed and analyzed by X-Ray photoelectron spectroscopy (XPS), X-Ray diffraction (XRD) and scanning electron microscopy (SEM). Hardness and adhesion force were tested by nanoindentation and scratch tester, respectively. The friction and wear behavior of TiN, TiNC, CrN/TiNC and TiN/TiNC films sliding against GCr15 balls were investigated and compared synthetically using ball-on-disk tribometer. It was found that Ti-N, Ti-C, Ti-N-C and C-C bonds were formed. The TiN/TiNC film was composed of TiN, TiC and TiNC phases. Hardness and adhesion force results indicated that although the TiN film possessed the highest hardness, its adhesion force was lowest among all the films. Tribological test results showed that the friction coefficient of TiN/TiNC was much lower than that of TiN and the wear rate decreases remarkably from $2.3 \times 10^{-15} \text{ m}^3/\text{Nm}$ to $7.1 \times 10^{-16} \text{ m}^3/\text{Nm}$, which indicated the TiN/TiNC film has better wear resistance.

Keywords

TiNC films

structure

friction

wear