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Mechanical and Corrosion Properties of CrZrN films synthesized by closed field Unbalance Magnetron Sputtering

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The binary nitride films such as TiN, CrN, AlN and etc. have been widely used as protective and wear resistant coatings on various tools because of their excellent properties. Recently, the various studies on the improvement of these binary thin films have been extensively made. In this work, in order to improve the mechanical and corrosion properties of CrN, the ternary Cr1-xZrxN films with 0<X<0.5 were synthesized on the substrates of Si(100) wafer and plasma nitrided H13 steel by closed field unbalance magnetron sputtering with vertical magnetron sources. Their mechanical and corrosion properties were investigated by ball-on-disk type wear test, scratch test, impact test and corrosion test. From the wear test against Al2O3 counterpart ball without lubricant at room temperature, friction coefficient of CrN film (x=0) was measured to be approximately 0.55 at the steady-state region while those from Cr1-xZrxN films with x=0.25 and x=0.34 were 0.2 and 0.25, respectively. Hardness and surface roughness values from Cr1-xZrxN films with x=0.25 were 34GPa and Rms=1.17 microns and those from Cr1-xZrxN films with x=0.34 were 32GPa and Rms=1.17 microns. and Rms=0.82 microns. The results from the scratch test showed that Cr1-xZrxN films (x=0.34) had the maximum critical load of 37.4N, while Cr1-xZrxN films (x=0.25) had 35.8N. Critical load tend to increase as the surface roughness decreases and detailed analysis results from corrosion tests will be presented.

References

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