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**Comparative study of microstructure and mechanical properties for  
films with various deposition rate by magnetron sputtering**

\*Kyung H. Nam\*, Yun M. Jung and Jeon G. Han

Center for Advanced Plasma Surface Technology,  
Sung Kyun Kwan University, 300 Chunchun-dong, Jangan-gu, Suwon 440-746 Korea

This paper investigated the effect of the film deposition rate for CrN<sub>x</sub> microstructure and mechanical properties. For these purpose, pure Cr and stoichiometric CrN films were deposited with various target power density on Si hardened M2 tool steel. The variation of nitrogen concentration in CrN<sub>x</sub> film analyzed by AES and deposition rate was calculated by measuring of thickness using  $\alpha$ -step profilometer. The microstructure was analyzed by X-Ray Diffraction and Scanning Electron Microscopy(SEM), and mechanical properties were evaluated residual stress, microhardness and adhesion tests. Deposition rate of Cr and CrN increased as an almost linear function of target power density from 0.25  $\mu\text{m}/\text{min}$  and 0.15  $\mu\text{m}/\text{min}$  to 0.43  $\mu\text{m}/\text{min}$ . Residual stresses of Cr and CrN films were from tensile to compressive stress with an increase of deposition rate a compressive stresses were increased as more augmentation of deposition rate maximum hardness value of 2300  $\text{kg}/\text{mm}^2$  and the best adhesion strength corresponded HF 1 were obtained for CrN film synthesized at the highest target density(13.2  $\text{W}/\text{cm}^2$ ) owing to high residual compressive stress and increasing mobility.