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Microstructure and Tribological Properties of Ti-Si-C-N Nanocomposite Coatings Prepared by Filtered Vacuum Arc Cathode Deposition

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The demand for low-friction, wear and corrosion resistant components, which operate under severe conditions, has directed attentions to advanced surface engineering technologies. The Filtered Vacuum Arc Cathode Deposition (FVACD) process has demonstrated atomically smooth surface at relatively high deposition rates over large surface areas. Preparation of Ti-Si-C-N nanocomposite coatings on (100) Si and stainless steel substrates with tetramethylsilane (TMS) gas pressures to optimize the film preparation conditions. Ti-S-C-N coatings were characterized using X-ray diffraction, X-ray photoelectron spectroscopy, transmission electron microscopy, nanoindentation, Rockwell C indentation and ball-on-disk wear tests. The XRD results have confirmed phase formation information of TiSiCN coatings, which shows mixing of TiN and TiC structure, corresponding to (111), (200) and (220) planes of TiCN. The chemical composition of the film was investigated by XPS core level spectra. The binding energy of the elements present in the films was estimated using XPS measurements and it shows present of elemental information corresponding to Ti2p, N1s, Si 2p and C1. Film hardness and elastic modulus were measured with a nano-indenter, and film hardness reached 40 GPa. Tribological behaviors of the films were evaluated using a ball-on-disk tribometer, and the films demonstrated properties of low-friction and good wear resistance.

Keywords: Ti-Si-C-N, Filtered Vacuum Arc, Tribological coating