Comparison of chromium carbide thin films grown by different power supply systems

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The potential use of chromium carbide thin films has been a great interest to academia and industry due to their outstanding properties such as chemical stability, low coefficient of friction, adequate hardness and high wear resistance. In this study, the chromium carbide thin films were fabricated by a magnetron sputtering using different power supply systems, including direct-current (DC), high power impulse magnetron sputtering (HiPIMS), and superimposed middle-frequency (MF)-HiPIMS. The Cr target poisoning status was controlled by a plasma emission monitoring system by adjusting the gas flow ratio of Ar and acetylene (C_2H_2). The morphology and microstructure of thin films were evaluated by scanning electron microscope. The crystallinity of films was studied using X-ray diffractometer. The electron probe micro analyzer, X-ray photoelectron spectroscope, and Raman spectroscope were used to determine the chemical compositions and binding structures of thin films. The mechanical, adhesion and tribological properties were explored by using scratch tester, tribometer, and nanoindentation. The influence of different power supply systems on the microstructure, chemical composition, and mechanical properties of chromium carbide films were investigated in this work.

Key words: HiPIMS, chromium carbide, acetylene, Raman spectroscope, mechanical properties.