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Structural, Optical, and Electrical Analysis of Sputtered Titanium Nitride Thin Films

Titanium nitride (TiN) thin films have attracted significant interest for supercapacitor applications due to their high electrical conductivity, chemical stability, and electrochemical durability. In this study, TiN thin films were systematically synthesized using magnetron sputtering under controlled Ar:N₂ flow conditions of 18:2 sccm. Films were deposited at temperatures of 500 °C, 600 °C, and 700 °C to investigate the influence of deposition temperature on structural and electrochemical properties. Structural characterization revealed that variations in surface morphology, grain size, and grain distribution significantly affected the electrochemical behavior of the films. Electrochemical measurements, including cyclic voltammetry and electrochemical impedance spectroscopy, demonstrated that the TiN thin films exhibited stable capacitive behavior, low internal resistance, and good rate capability. These results indicate that sputtered TiN thin films possess favorable charge storage characteristics and long-term electrochemical stability, highlighting their potential as electrode materials for supercapacitor energy storage applications.

Academic or Professional Status

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