Optimization of Spectral and Angular Selectivity in Obliquely Deposited TiO2/Ag/TiO2 Thin Films Prepared by Thermal Evaporation and Sputtering Methods

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Abstract:

Optical properties of obliquely deposited TiO2/Ag/TiO2 multilayered films prepared by thermal evaporation and sputtering methods were investigated for energy efficiency of architectural and automobile windows. Investigation on the influency of layer thickness on the properties of TiO2/Ag/TiO2 films yield an optimum layer thickness of 5 nm/14 nm/5 nm and 10 nm/14 nm/10 nm for optimal solar control performance of TiO2/Ag/TiO2 films deposited by sputtering and thermal evaporation methods. The optimum films were then obliquely deposited with deposition angle varying from 0º to 70º for the purpose of optimizing angular selectivity of the films. The spectral transmittances were measured by HITACHI model U-2000 double beam UV-VIS-Spectrophotometer. The optimum thickness provided a peak transmittance of 70% at a wavelength of 400 nm for near normal thermally evaporated thin films, and 72% for films deposited by sputtering unit at ~ 320 ° C for TiO2 layers. Influence of deposition angle for obliquely deposited thin films was investigated for both sputtered and thermal evaporated thin films. The transmittance values for the films deposited by both methods gradually increased with increasing deposition angles to a peak of 80% at 400 nm wavelength. The angular transmittance measurements were taken for the optimum films with 10 nm/14 nm/10 nm thicknesses due to relatively larger overall film thickness as compared to 5 nm/14 nm/5 nm. Films deposited at 30º , 40º and 60º , with incident light angle of ± 10º , ± 30º , ± 50º and ± 70º were used for transmittance measurements. Best angular performance of 7% was realized at ± 10º light incidence angle for films prepared at 60º deposition angle.

Key words: Spectral selectivity, angular selectivity, multilayered films, oblique deposition.