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**Improved performance of thermochromic VO₂/SiO₂ coatings prepared by
low-temperature pulsed reactive magnetron sputtering:
prediction and experimental verification**

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Abstract

The paper deals with thermochromic VO₂/SiO₂ coatings prepared by low-temperature pulsed reactive magnetron sputtering on conventional soda-lime glass substrates without any substrate bias and without any interlayer. Thermochromic VO₂ layers were deposited using reactive high-power impulse magnetron sputtering with a pulsed O₂ flow control at a substrate surface temperature of 300 °C. Antireflection SiO₂ layers were deposited using mid-frequency bipolar dual magnetron sputtering onto the top of VO₂ layers at a surface temperature below 35 °C in order to improve the optical and mechanical performance. We focus on the dependence of the luminous transmittance (T_{lum}) and the modulation of the solar transmittance (ΔT_{sol}) on the SiO₂ layer thickness. The measured dependencies are in good agreement with those predicted using properties of pure VO₂ layers measured by spectroscopic ellipsometry. Two different VO₂ layer thicknesses (30 and 88 nm) have been used to demonstrate the tradeoff between T_{lum} and ΔT_{sol} . We show an improvement due to the SiO₂ overlayer of up to 16% (from 40.3% to 56.3%) for T_{lum} measured at 25 °C and up to 2.6% (from 7.7% to 10.3%) for ΔT_{sol} . The results are important for the design and low-temperature fabrication of high-performance durable thermochromic VO₂-based coatings for smart window applications.

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