

# **Thermochromic VO<sub>2</sub>-based multilayer films with enhanced luminous transmittance and solar modulation**

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## **Abstract**

Vanadium dioxide (VO<sub>2</sub>) shows an abrupt and reversible change in optical and electrical properties when the temperature is raised beyond a critical point of ~68 °C. Films made from this material have a potential to be used in energy efficient “smart” windows with temperature-dependent throughput of solar radiation. Two of the drawbacks of this material have been its low luminous transmittance and limited solar modulation of transmittance during switching. In this work we report calculations and experiments on multilayers of VO<sub>2</sub> and TiO<sub>2</sub>, produced by reactive DC magnetron sputtering, that significantly improve the luminous transmittance and solar modulation of the films during switching. We also explore the angular-dependent transmittance of five-layer TiO<sub>2</sub>/VO<sub>2</sub>/TiO<sub>2</sub>/VO<sub>2</sub>/TiO<sub>2</sub> films and demonstrate that the modulation of luminous and solar transmittance can be enhanced at non-normal angles of incidence.