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THERMOCHROMIC $V_{1-x}M_xO_2$ THIN FILM FOR SMART WINDOWS

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Thermochromism is the phenomenon that a material changes its crystal structure with temperature, hence luminous and infrared solar transmittances vary with temperature.

Thermochromism of VO_2 and $V_{1-x}M_xO_2$ thin films were investigated with the aim of lowering their transition temperature to 30℃, which is the temperature of car window in Summer time.

Thin films of VO_2 and $V_{1-x}M_xO_2$ were prepared by e-beam evaporation or reactive e-beam evaporation technique onto a glass substrate and the resistivity of these thin films were measured with LCR meter and pico-ammeter.

Luminous and near-infrared solar transmittances were examined by a spectrophotometer.

Thermochromism was found in both thin films, and the transition temperature (from semicondutor to metal) could be lowered in $V_{1-x}M_xO_2$ by proper heat-treatment.

The level of doping element in the $V_{1-x}M_xO_2$ thin film was found to be critical to lower the transition temperature of this thermochromic thin films.

The substrate temperature and annealing temperature were found to be also important to enhance the crystallization of VO_2 and $V_{1-x}M_xO_2$ thin film, thereby they can give thermochromic effect.

We were able to reduce the near-IR solar transmittance by 80 percent at 30℃ in $V_{1-x}M_xO_2$ thin film , which were fabricated by e-beam technique at the substrate temperature of 300℃ and annealed at 300℃ for 10 hours in air.

The characteristics of thin films were studied by XRD and ESCA.

Reference

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