

Case studies in thermal treatment for energy efficient multilayer thin films by the sol-gel method

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Spectrally selective glazing system attracts great attention for energy efficient window applications. In order to reflect light selectively, multilayer thin films consisting of high/low/high ($\text{TiO}_2/\text{SiO}_2/\text{TiO}_2$) refractive index materials were prepared by sol-gel synthesis and spin coating process. However, the multilayer structure often shows some troubles such as cracks or delaminations resulted from hydrophobic surface of the pre-deposited layer, especially in the case of SiO_2 layers. The hydrophobic property characterized by using the contact angle measurement originates from residual ethoxy groups in the SiO_2 layer. Removal of residual ethoxy groups makes the contact angle lower and then the multilayer formation possible. Namely, the $\text{TiO}_2/\text{SiO}_2/\text{TiO}_2$ multilayer structure was accomplished by thermal treatments of hydrophobic film surface. The reflectance spectra experimentally measured from multilayer films were in good agreement with the theoretical calculations by incorporating variable refractive index into the transfer matrix, so it is possible to modulate reflectance of multilayer films for energy efficient transparent window applications.