SOLAR CONTROL ON IRRADIATED Ta_2O_5 THIN FILM

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ABSTRACT

Thin films consisting of Ta_2O_5 have been used in industry in applications related to thin-film capacitors, optical waveguides, and antireflection coatings on solar cells. Ta_2O_5 films are used for several special applications as highly refractive material and show different optical properties depending on the deposition methods. Sol-gel technique has been used for the preparation of Ta_2O_5 thin films. Ta_2O_5 thin films were prepared by sol-gel prosses on glass substrates to obtain good quality films. These films were exposed to gamma radiation from Co-60 radioisotope. Ta_2O_5 coated thin films were placed against the source and irradiated for 8 different gamma doses; between 0.35 and 21.00 kGy at room temperature. Energetic gamma ray can affect the samples and change its colour. On the other hand some of the Ta_2O_5 coated thin films were irradiated with beta radiation from Sr-90 radioisotope. The effect of gamma irradiation on the solar properties of Ta_2O_5 films is compared with that of beta irradiation. The solar properties of the irradiated thin films differ significantly from those of the unirradiated ones. After the irradiation of the samples transmittance and reflectance are measured for solar light between 300 and 2100 nm, by using Perkin Elmer Lambda 9 UV/VIS/NIR Spectrophotometer. Change in the direct solar transmittance, reflectance and absorptance with absorbed dose are determined. Using the optical properties, the redistribution of the absorbed component of the solar radiation and the shading coefficient (SC) are calculated as a function of the convective heat-transfer coefficient. Solar parameters are important for the determination of the shading coefficient. When the secondary internal heat transfer factor (q_i), direct solar transmittance (τ_e), and solar factor (g) are known, it is possible to determine shading coefficient via the dose rates. The shading coefficient changes as the dose rate is increased. In this study, the shading coefficient is related to the colour centres, which are both present as intrinsic defects in structure and created induced defects by irradiation. The optical absorption bands were investigated depending on the gamma and beta irradiation. The changes of solar properties on irradiated Ta_2O_5 films are associated with the formation of defect centers and radiolytic electrons or holes. Under irradiation, the defects centers are formed as a result of charge trapping by radiolytic electrons or holes. It can be said that the control of solar energy is possible while the shading coefficient decreases in the irradiation condition.

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