Abstract

The thesis focuses on characterization of optical thin films by photometry and utilization of such analytical process obtained from the study on anti-reflection (AR) coatings. Zirconium Dioxide (ZrO_2) films were first prepared by reactive magnetron sputtering and thermal oxidation. Such films were then characterized by spectroscopic ellipsometry (SE) and spectrophotometry techniques. During the SE analyses, the ZrO_2 films were investigated for structural and optical properties based on SE modeling process. This process involves constructions of physical and optical dispersion models. The study demonstrated that, based on the SE physical model, the prepared ZrO_2 films were best described by a double-layer film structure which indicated inhomogeneity within the films. Based on the SE optical model, the prepared films were best described by two Tauc-Lorentz oscillators for optical dispersion covering ultraviolet to near-infrared regions. This optical dispersion models could be used to extract for optical constants of the films. In comparison, the ZrO_2 films were measured by spectrophotometry and were calculated for film thicknesses and refractive indices based on the Swanepole method. When the film thickness was increased, the accuracy of the results obtained from the method was also increased. The obtained film thicknesses from both SE and spectrophotometry were later confirmed by the field-emission scanning electron microscopy (FE-SEM).The results showed that, the thicknesses obtained from both techniques fell within 6% from the actual results obtained from the FE-SEM. Finally, the highly accurate SE analyses were utilized in characterization of multi-layer thin films for AR coatings prepared by three different optical coating systems in order to identify their coating efficiency.