

Method of LED spectral ellipsometry with switching orthogonal polarization states

Abstract

This thesis presents an information-measuring system (IMS) for monitoring optical constants and thicknesses of thin films, which implements a modified spectroscopic ellipsometry method with a wide-range LED radiation source, which reduces the error and increases the reproducibility of measurements of ellipsometric parameters with a concomitant improvement in the technical and economic characteristics of the measuring installation. Using mathematical modeling of the process of four-zone static ellipsometric measurements, the influence of unavoidable noise on the error in estimating ellipsometric parameters in a finite number of specified azimuthal positions of the polarization devices of the measuring path was analyzed, which made it possible to determine the fundamental accuracy limit of the static measurement scheme. A distinctive feature of the presented IMS is the use of a set of LEDs as a broadband radiation source of a spectroscopic ellipsometer, which provides a continuous spectral profile in the UV-Vis-NIR range with the required signal-to-noise ratio. The developed original polarizing devices make it possible to increase the resistance of the IMS to external influences, such as vibration and temperature fluctuations, and the theoretical investigations are confirmed by the results of operating a laboratory sample of the developed IMS for monitoring the optical constants and thicknesses of thin films presented in Chapter 8 of this work.

Keywords: information-measuring system, monitoring and control process, thin films, optical constants, spectroscopic ellipsometry