

Master 2018

Ms. Sarayu Yammanuru

Investigation of the Influence of Polarization on Angle-Dependent Optical Measurements.

ABSTRACT - Masterthesis

Electric lighting is usually responsible for approximately one third of the total primary energy demand in energy-efficient buildings. The installation of façade systems which allow the usage of daylight is therefore an important measure to reduce the energy demand for electric lighting. "Solar Control" refers to measures which limit the amount of solar radiation in entering a building so that it does not lead to further overheating or glare. Solar-control systems can help to reduce the energy consumption of buildings, to provide visual comfort, to ensure healthy natural lighting and, if solar-active components are used, can also generate solar electricity and solar heat at the same time. In developing such solar-control systems for building facades, blind materials play a key role and their visible and solar optical characteristics provide important technical information to guide the selection of these materials. The angular distributions of these characteristics can be measured using a Goniophotometer, which measure the reflected and transmitted light scattered from a sample. At Fraunhofer ISE, a 3-dimensional scanning goniophotometer is used, which is equipped with detectors that are moved around the sample.

The project, within which my M.Sc. work was carried out, aims to develop switchable textile facade components based on improved methods for evaluating the performance of complex window and window facade systems. Improved evaluation methods are needed, as some problems have been encountered in characterizing the optical properties of solar-control fabrics which had to be overcome. My thesis work focuses on measuring BSDF (bidirectional scattering distribution function) of different solar-control fabrics in the solar spectral range (280 nm – 2500 nm), using the scanning goniophotometer, with spectrophotometric measurements also being used for comparison. The results of these measurements (goniophotometer) are compared with spectrally integrated transmittance and reflectance with combinations of different sources and detectors that are calculated over entire solar spectrum wavelength range.

As polarization is an important characteristic of skylight, this report also focusses on investigating the effect of polarization on the measured transmittance, reflectance and BSDF results for the solar-control fabrics. After characterising the spectral degree of polarization for the different types of polarizers that are available, the most

suitable polarizer was selected and was used in the scanning goniophotometer. The polarizers were initially used to determine whether the illumination from lamps is polarized and whether the detectors of the goniophotometer are sensitive to polarization, and then to measure polarization-dependent BSDF for glass and selected solar-control fabrics.