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THE SUMMARY OF Ph.D. DISSERTATION

School of Integrated Design Engineering	Doctor Identification Number	OKUMURA, Takamitsu

Title

Analysis of Multiple Scattering in an Optical Polymer and their Applications

Abstract

Most of information displays require various optical components made of highly transparent polymer materials. So far many studies have been conducted on eliminating scattering factors in materials on the basis that scattering leads to the energy loss. However, we proposed a hazy polymer containing spherical particles and confirmed the advantage to obtain a uniform distribution of brightness. In the present work, we investigate the multiple scattering in a polymer theoretically and experimentally, and then applied the results to functional materials based on the multiple scattering.

Chapter 1 describes the brief summary of the motivation for the present work.

Chapter 2 summarizes the theoretical fundamentals of light scattering. Some notable scattering theories are reviewed and considered the validity for this work.

Chapter 3 demonstrates the method for calculating the multiple scattering in a polymer containing small particles. The developed modeling simulation program employs a Monte Carlo method based on Mie scattering theory.

In Chapter 4, materials and fabrication technique of a polymer containing scatterers are presented. Experimental methods for evaluating the multiple scattering are also described.

In Chapter 5, we evaluate the basic behavior of multiple scattering that concerns dependences of the intensity distribution on the internal particle conditions. The calculated results are compared with measured results, and then discuss the error factor by assuming the model that involves the effect of adjacent particles.

In Chapter 6, a multiple scattering behavior of the optically anisotropic particles is evaluated. We proposed the polarizer based on light scattering with anisotropic particles.

In Chapter 7, we proposed the backlight for LCD that requires no optical films. This backlight is provided with microprisms at the bottom surface, which can reflect directly the incident light into the front direction.

In Chapter 8, we proposed another application based on the multiple scattering, the high-definition screen for rear projection display. We devise a technique that enhances the contrast in an ambient light.

Chapter 9 summarizes this study.