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Achromatized Super Twisted Nematic LCD Using Polymer Retardation Film

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Abstract A new optical compensation method using retardation film has become possible to display black-and-white graphics in Super Twisted Nematic (STN) LCD.

Introduction

STN-LCD has suffered from the problem of the background area becoming colored due to the use of birefringence effect. Extensive efforts have been made to resolve this problem, and we have seen a number of successes in this area [1-3].

We have investigated viability of a method called Retardation Control by Film (RCF) method which provides optical compensation to STN-LCD using a polymer film.

Retardation Control by Film Method

The key item of this new technology is the polymer retardation film, named Retardation Control film (RC-film), which is 80 μm-thick and monoaxially expanded polycarbonate layer. The expanded film does not contain any dyes, also does not have rotatory power. Polymer molecules in the film are homogeneously oriented in one direction parallel to the surface.

The construction of this method is indicated in Fig.1, as easily shown that the main structual elements are STN-LCD, a couple of polarizer and RC-film. RC-film installed on STN-LCD and also a couple of polarizer is used, one being put

under the STN-LCD while the other on the RC-film.

The optical principle is explained by referring to Fig.2. Liquid crystal's refractive index anisotropy and liquid crystal molecules' twist structure generate phase differences on the linearly polarized light that enters STN-LCD, and the light exiting from STN-LCD becomes elliptically polarized with different ellipticity and polarization angle for each of R,G and B wavelengths. Without some means to compensate for this optical phenomenon, the intensity of each wavelenghth will differ, causing coloring no matter what angle the exit side polarizer is set at.

To provide optical compensation on STN-LCD, we used a uniaxially drawn polymer film. The RC film has refractive index anisotropy, and it can restore the elliptically polarized light exiting from STN-LCD to a linearly polarized light, enabling black-and-white display on STN-LCD panel.

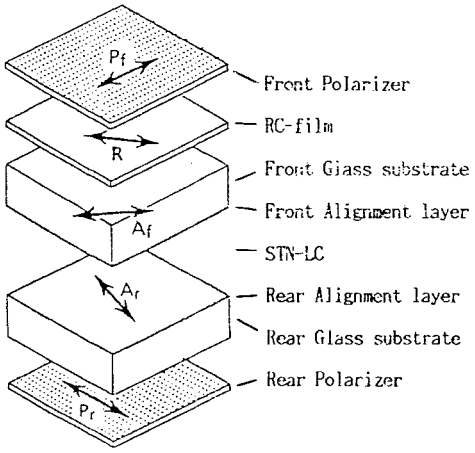

Fig.1 Construction of RCF-LCD

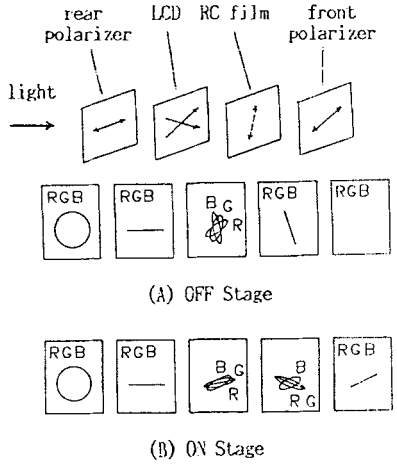

Fig.2 Polarization of transmitted light in RCF-LCD

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