Microwave variable delay line using dual-frequency switching-mode liquid crystal

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A microwave variable delay line using liquid crystal (LC) has been investigated. This paper describes a method to reduce the insertion loss and the response time of the phase shift in the variable delay line. In variable delay lines using the conventional nematic LC employed in ordinary display devices, reducing the insertion loss conflicts with reducing the phase-shift response-time dependence on the thickness of the LC layer. Thus, it is very difficult to simultaneously satisfy both requirements. Here, the use of dual-frequency switching-mode liquid crystal (DFSM LC) for the variable delay line is demonstrated as one approach to solving this problem. By using the characteristic of DFSM LC that the alignment of the LC can be controlled with a control voltage and its frequency, it becomes possible to control the LC alignment so that it is in an always electrically driven condition by applying a combination of control voltages of dc and several kHz. Experimental results for a microwave variable delay line using DFSM LC show that it is possible to reduce both the phase-shift response time and the insertion loss.

Wavelength selectivities of organic photoconductive films: Dye-doped polysilanes and zinc phthalocyanine/tris-8-hydroxyquinoline aluminum double layer

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Organic photoconductors sensitive to blue, green, and red light were fabricated using coumarin 6 (C6)-doped poly(m-hexoxyphenyl)phenylsilane (PHPPS), rhodamine 6G (R6G)-doped polymethylphenylsilane (PMPS), and zinc phthalocyanine (ZnPc) / tris-8-hydroxyquinoline aluminum (Alq3) double layer, respectively. Selectivities of the spectral responses of these films were good enough to divide the incident light into three primary-color components. The present results indicate that only choosing organic materials can tune photoconductive properties, especially wavelength selectivities of the film, which enables us to move toward a compact, lightweight and high-resolution color camera without a prism. In present broadcast cameras, incident light is separated into blue-, green-, and red-components by a dichroic prism and then, they are detected individually by three photoelectric conversion devices such as a charge-coupled device or an image pick-up tube.

The internal quantum efficiency (defined as the number of electrons divided by the number of absorbed photons) of a ZnPc/Alq3 double layer film is over an order of magnitude better than those of C6-doped PHPPS and R6G-doped PMPS films due to the dissociation of electron-hole pairs generated at the interface between ZnPc and Alq3.

A proposal for the modification of s-CIELAB

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The authors are developing an ultrahigh-definition video system for future broadcasts. In this system, the color reproduction is as important as the resolution, and an appropriate metric is necessary to evaluate the color reproduction in images. The s-CIELAB, which has been introduced by researchers at Stanford University, is a strong tool for evaluating color reproduction error in images. However, the formula is not yet completed and a few refinements to it will enhance the accuracy of this tool. In a simple simulation, a black-white pattern caused unexpected false color components with the s-CIELAB formula. The authors show how these false color components are obtained with this formula. The main reason is a combination of components from different low pass filters (LPFs). A method to improve this situation is shown by introducing new psychological values, and a modification to the formula employed by s-CIELAB is proposed. The new formula is compatible with the psychological values L*u*v* of CIE, and a simulation with general images shows that the new method does not cause any false color components.