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B-3-3 PLZT Application to Image Display Devices

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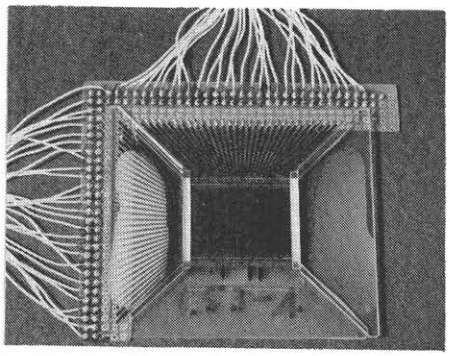
The most conventional approach to construct flat panel display devices would be a matrix-addressing. For matrix-addressing, a well-defined threshold switching characteristic and a reliable memory function are needed. A well-defined threshold requires extreme non-linearity of the switching characteristics. Whereas, gray-scale controlling requires linear response to an input signal. Therefore, to realize matrix image displays, panel material must have these characteristics simultaneously.

Present paper provides an approach to this problem by utilising field-induced reversible transitions between anti-ferroelectric and ferroelectric phases of La doped lead zirconate-titanate(PLZT) ceramics.[1)]

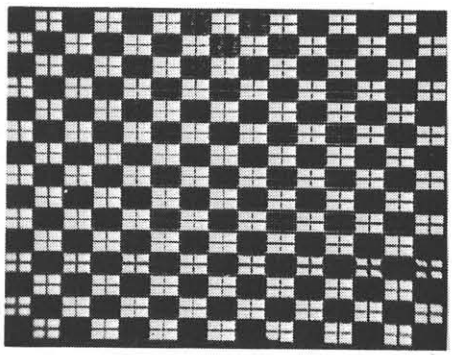
The experimental samples are transparently hot-pressed 7.9/70/30-PLZT ceramic plates.[2)] From switching time measurements, the value n was 10 in the following equation of switching time (t_s) vs field (E),

$$1/t_s = \gamma E^n$$

where γ is a constant. The value n=10 shows large non-linearity enough to avoid half-select voltage disturbances in large scale matrix displays. Fiqure 1 shows photographs of a PLZT 30x30 bits matrix panel and a single checker-board pattern displayed by it.



(a) 30x30 bits matrix panel



(b) Single checker board pattern

Fig. 1. Photographs of a PLZT matrix panel (a), and its displayed pattern (b).

This non-linear response seems to be disadvantageous to the linear response required for gray-scale controlling. Here, the present display material works as a scattering mode, and the light scattering power depends on the ratio of ferroelectric parts to the total ceramic volume.[3] The ratio is proportional to the charge density on the electrode. Therefore, we can get the idea of "charge control method" that is to control the integral amount of switching current.

Figure 2 shows a charge control circuit and its experimental results of a gray-scale display. The access method is the line at a time addressing: line selection and gray-scale controlling are separatedly operated as that a line selection signal is given through line side inputs and gray-scale signal is given through digit-side inputs. Here, the gray-scale signal input circuit is consistents of a transistor connected in series to a PLZT element (Fig. 2(a)).

In conclusion, the present results show potential applicabilities of PLZT to image display devices.

REFERENCES

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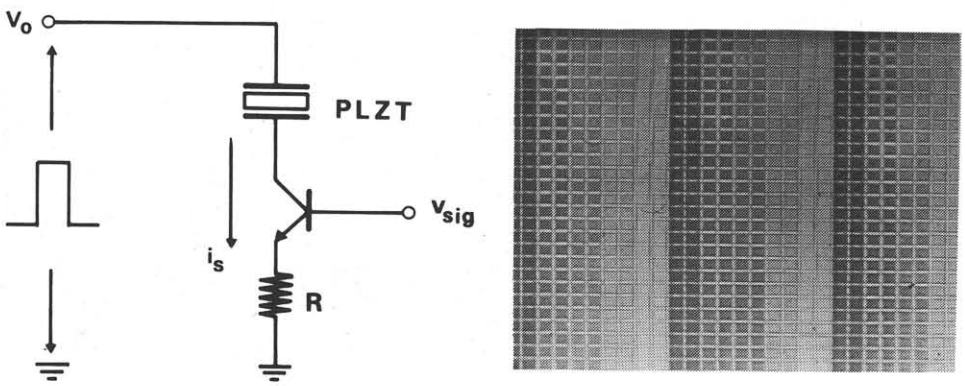

(a) (b)

Fig. 2. A charge control circuit (a) and a photograph of its gray-scale display (b).