C — 3 — 2 Contact-Type Linear Sensor Using Amorphous Si Diode Array

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Recently, contact-type linear sensors which are of the same width as a document have attracted attention because of their potential for use in the facsimile readers.[1),2)] Linear sensors using amorphous Si (a-Si) in the photodetector element are considered especially promising because of their short photoresponse time, the uniformity of deposited film, and the simplicity of the fabrication process.[3),4)] However, previously reported linear sensors using a-Si have consisted of both photodiodes and associated FET switching devices. Therefore, a large number of leads and switching devices were required, making it difficult to connect the photodiodes and switching devices. In order to avoid this difficulty, we have developed a sensor element consisting of an In_2O_3/a-Si diode and a Pt/a-Si diode which operate as photo- and blocking diodes, respectively.

Fig. 1 shows the two types of diode structures proposed here and their current-voltage characteristics. A Tungsten lamp with a color temperature of 2856K is used as the light source. In these diodes, a-Si is deposited through capacitively-coupled RF glow discharge from SiH_4 diluted with Ar at a substrate temperature of 250°C, an rf power of 10 W, a gas flow rate of 65 sccm and a gas pressure of 0.1 torr. The thickness of the a-Si layer is 0.5 μm. As is apparent from the figure, both the photocurrent and dark current in the In_2O_3/a-Si diode are considerably higher than is the case in the Pt/a-Si diode. Fig. 2 shows the output voltage of the In_2O_3/a-Si diode as a function of integration time, which is the repetition time of the clock pulse applied to the FET switching gate. The measurement circuit is inserted in the figure. Each cell of the diode is 100 μm square. The In_2O_3/a-Si diode was found to provide a signal level which is high enough for use in facsimile readers.

We fabricated a 256-element contact-type linear sensor using the In_2O_3/a-Si and Pt/a-Si diodes as photo and blocking elements, respectively. The structure of the linear sensor, which includes far fewer switching FETs than those in the conventional sensor, is shown in Fig. 3. In this structure, the Pt/a-Si diode acts to suppress leakage current flowing into the video line. Fig. 4 shows a cross-sectional view of the linear sensor. Each cell of the photo and blocking diodes is 100 μm square. A NiCr layer assures Pt adhesion to the glass substrate and prevents stray light from entering the blocking diodes. Photosensitive polymer (CBR) is used as an intermediate insulator to separate the upper

individual electrodes (Al) from the lower ones (Au/Cr). The sensor is constructed to detect incident light introduced through the glass substrate; this is effective in eliminating sensor surface contamination. A photograph of the linear sensor is shown in Fig. 5.

The results obtained with this device confirmed the suitability of linear sensors using In_2O_3/a-Si and Pt/a-Si diode in high speed contact-type facsimile machines.

References

1) K. Komiya et al., IECE (Japan) IE80-72, 1980.

2) H. Yamamoto et al., 9th Conf. Image Tech., 115, 1978.

3) T. Hamano et al., Proc. 13th Conf. SSD, Tokyo, 245, 1981.

4) Y. Kanoh et al., IEDM81-313, 1981.

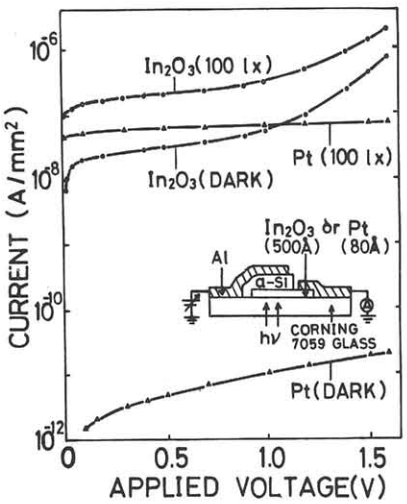

Fig. 1 I-V characteristics of In_2O_3/a-Si diode and Pt/a-Si diode

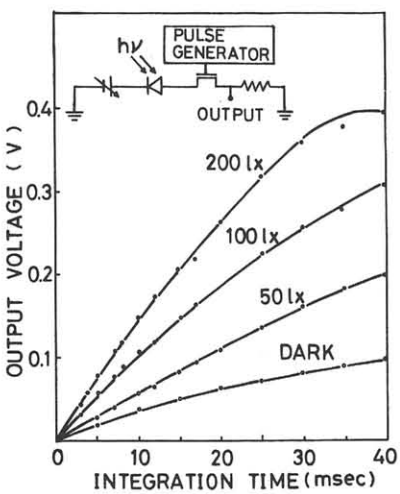

Fig. 2 Dependence of output voltage of the In_2O_3/a-Si diode upon integration time

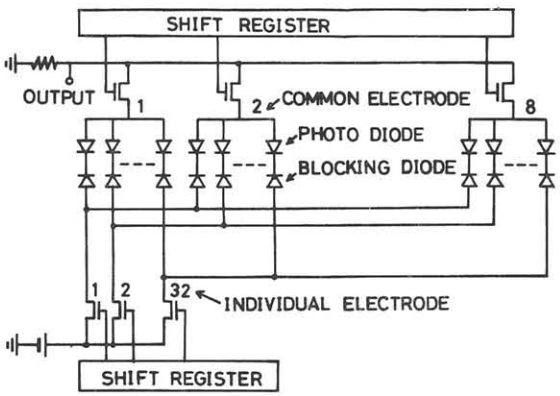

Fig. 3 Structure of a-Si linear sensor

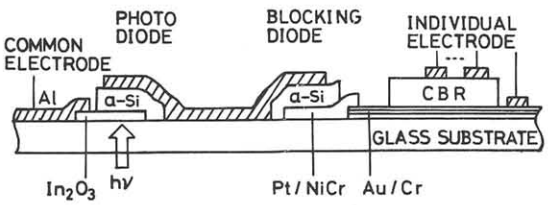

Fig. 4 Cross-sectional view of the a-Si linear sensor

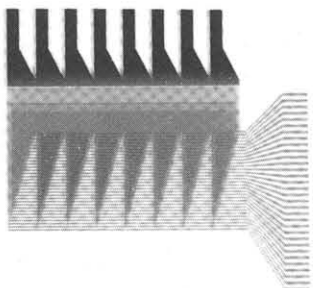

Fig. 5 Photograph of the linear sensor