Tin Oxide Thin Film Transistors

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A tin oxide thin film transistor was reported to be produced by the vacuum evaporation process, its transconductance being 0.3 m mho.[1] However, no attempt has been made to obtain SnO_2 TFT's by other methods. In the present work are reported the TFT's having tin oxide film grown from vapor phase reaction as their semiconductor layer, because this preparation method is expected simpler than the vacuum evaporation method and the films made by this method have higher electric conductivity.

The apparatus used for this growth method is shown in Fig. 1. Tin oxide films were grown by transporting the vapor of dimethyl tin dichloride onto the substrate surface with dried air and by decomposing and oxidizing it successively there. The thickness of a tin oxide film was controlled by changing the flow rate of dried air and the reaction time. The electric conductivity of the film was controlled by changing the temperature of substrate at the reaction. Glazed alumina was used for the substrate. A coplanar type was employed for the TFT structure. The film was a few microns in thickness. Source, drain and gate electrodes were mostly made of aluminum. Various compounds were applied for insulator layer, but only the double layer composed of SiO and nitrocellulose was useful and the TFT's which used it showed, exceptionally, d.c. characteristics of TFT at low gate voltages. The d.c. caracteristics of the TFT's is shown in Fig. 2. Its transconductance is about 0.3 m mho, which is comparable to that obtained by Klasens *et al.*

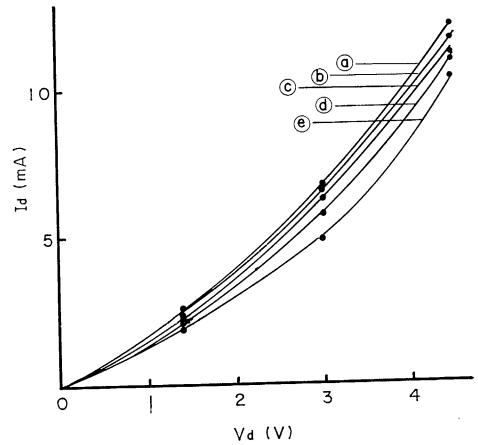

Fig. 2. D.C. characteristics of a SnO_2-TFT by vapor phase growth method.
Gate voltage: a: 0 V, b: 2 V, c: 4 V, d: 6 V, e: 8 V.

Reference

1) H. A. Klasens and H. Koelmans: Solid State Electronics **7** (1964) 701.

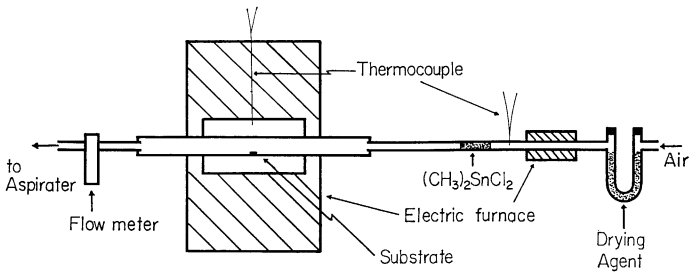

Fig. 1. Apparatus for depositing SnO_2 film.