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Extraction Method of Temperature-Independent Subgap Density-of-States of a-IGZO TFTs by using Fermi-Dirac distribution

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Recently, amorphous In-Ga-Zn-O (IGZO) thin-film transistor (TFT) has been employed as driving device in manufacturing the next-generation displays [1]. Especially, the subgap density-of-states (DOS) distribution affect the operation and reliability of amorphous semiconductor TFTs. Therefore, electrical extraction techniques of DOS in IGZO TFTs through various method were reported [2, 3]. However, these methods have not considered the effects of higher temperatures, which cause the over/underestimated DOS.

In this work, we propose an extraction method of temperature-independent DOS by using photonic *C-V* and Fermi-Dirac distribution [3]. As the temperature increases, the slope and V_T of the photonic *C-V* become lower as the temperature increases (Fig. (a)). As a result, the high DOS was extracted as temperature increase (Fig. (b)) because of increased pumped DOS area as relationship between electron probability of Fermi-Dirac distribution and temperature (Fig. (c) and (d)). Therefore, we extracted the temperature-independent DOS as the pumped area according to the temperature. Our result guide the more sophisticated design and optimization of a-IGZO TFTs.

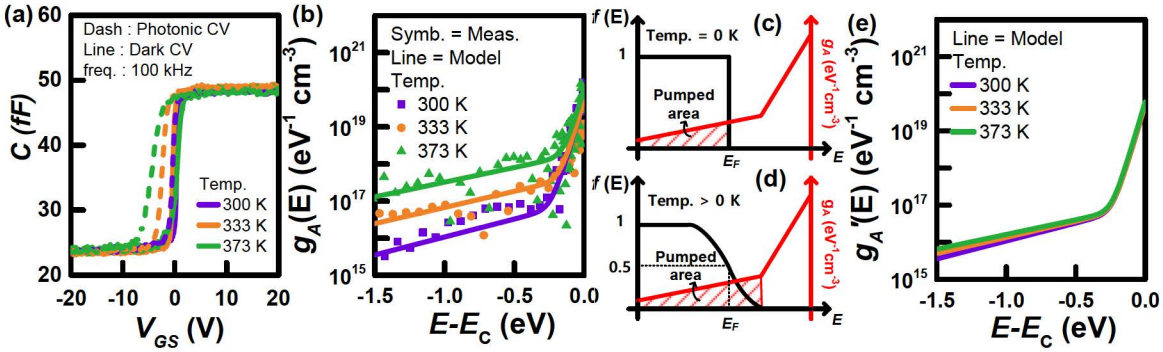

Fig 1. (a) C-V_{GS} curves under dark and photo condition, (b) g_A(E)-E. Figure illustrating the change in the area of the pumped DOS as the temperature is (c) 0 K and above (d) 0 K. (e) Temperature-independent DOS curve.

References: [1] J. Y. Noh, et al., *SID 2017 Digest*, pp. 288-290(2017), [2] M. Dai, et. al., *Sci. Rep.*, vol. 6, p. 24096, (2016), [3] H. Bae, et. al., *IEEE Electron Devices lett.*, vol. 61, no. 11, pp. 3566-3569, (2014).

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