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Performance Improvements of Tungsten and Zinc Doped Indium Oxide Thin Film Transistor by Fluorine Based Double Plasma Treatment with a High-K Gate Dielectric

Dun-Bao Ruan^a, Po-Tsun Liu^{b,*} ptliu@mail.nctu.edu.tw, Yu-Chuan Chiu^b, Min-Chin Yu^b, Kai-Jhih Gan^a, Ta-Chun Chien^b, Yi-Heng Chen^b, Po-Yi Kuo^b, Simon M. Sze^a

^aDepartment of Electronics Engineering and Institute of Electronics, National Chiao-Tung University, Hsinchu, Taiwan, 30010, R.O.C.,

^bDepartment of Photonics, National Chiao-Tung University, Hsinchu, Taiwan, 30010, R.O.C.,

*Corresponding author.

Abstract

The electrical characteristics and XPS analysis for the amorphous tungsten and zinc doped indium oxide thin film transistor, which was performed with single or double different fluorine based remote plasma treatment, were investigated in this study. A high mobility TFT device with the tungsten doped channel was fabricated in the previous study, but there was an inevitable negative shift for the threshold voltage, which will be a limit for the application of systemic circuit design. Therefore, a double fluorine based remote plasma treatment process is proposed for the high electronegativity of fluorine element and its similar radius as oxygen, which can be used to terminate the donor-like oxygen vacancy. It may induce a positive shift of threshold voltage, while carrier concentration and field effect mobility might be maintained. As a result, the sample with CF₄/N₂+O₂ plasma treatment exhibits a higher on/off current ratio of $\sim 4.73 \times 10^6$, a lower sub-threshold swing value of 0.070 V/decade, and a lower interfacial trap density value of $5.21 \times 10^{11} \text{ eV}^{-1} \text{ cm}^{-2}$ than other samples, while there is even a desirable

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