Oxide Thin Film Transistors for Flexible Devices

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Much attention has been gathered to flexible devices which will surely change our life style drasticall y. There are many kinds of flexible devices such as flexible display or medical chart. In order to realize the flexible devices, oxide thin film is one of the promising material. Because oxide film has several fea tures which are not observed in conventional silicon materials. They are low fabrication temperature, hig h electrical performance or unique optical properties. To realize flexible devices with oxide thin film, sev eral key issues should be discussed. In this talk, we will introduce several new techniques which are no w being developed in our laboratory (Fig.1).

We study the fabrication method of high performance oxide thin film transistors by using solution pro cessed InZnO. High mobility and highly reliable TFT was demonstrated using spin coating method. In th is technique, there was a problem of larger fluctuation of the performance. To solve this problem, we in troduced wet annealing after the TFT fabrication and achieved very low fluctuation of the electrical perf ormance such as mobility of threshold voltage. We apply this solution processed InZnO to logic circuit s uch as invertor or ring oscillators. We could demonstrate clear invertor operation or high frequency circu it operations.

We demonstrate ELA on *a*-IGZO TFTs passivated with a hybrid passivation layer. The hybrid passivation layer, based on polysilsesquioxane (PSQ), is transparent and fabricated by solution process. The PSQ passivated a-IGZO TFTs has a bottom gate top contact structure. The channel used is a 70 nm thick *a*-IGZO (2217) deposited at room temperature by RF magnetron sputtering. PSQ passivated TFTs were subjected to either 248 nm KrF ELA or 308 nm XeCl ELA at room temperature and atmospheric pressure. Irradiating Me 100 samples with 90-110 mJ/cm^2 XeCl ELA and Me 60/Ph 40 samples with 80 mJ/cm^2 KrF ELA greatly improved the transfer characteristics and mobility (~13-18 cm^2/Vs)[1-2](Fig.2).

For gate insulator of amorphous InGaZnO thin-film transistor, we fabricated fluorinated silicon nitride (SiN:F) film formed by an inductively-coupled plasma enhanced chemical vapor deposition method by utilizing SiF_4/N_2 as source gases. Threshold voltage shift against electrical stress was successfully suppressed. Chemical analysis revealed that the hydrogen concentration was reduced to 1/10 of conventional SiN film and fluorine was introduced into the interface between the SiN:F film and channel layer. We conclude that the decrease of hydrogen content and introduction of fluorine lead to decrease of electron trap density at the interface and/or the SiN:F film[3].

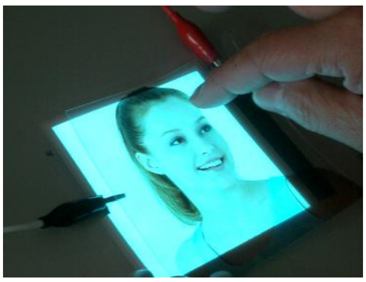

Fig.1 Flexible display

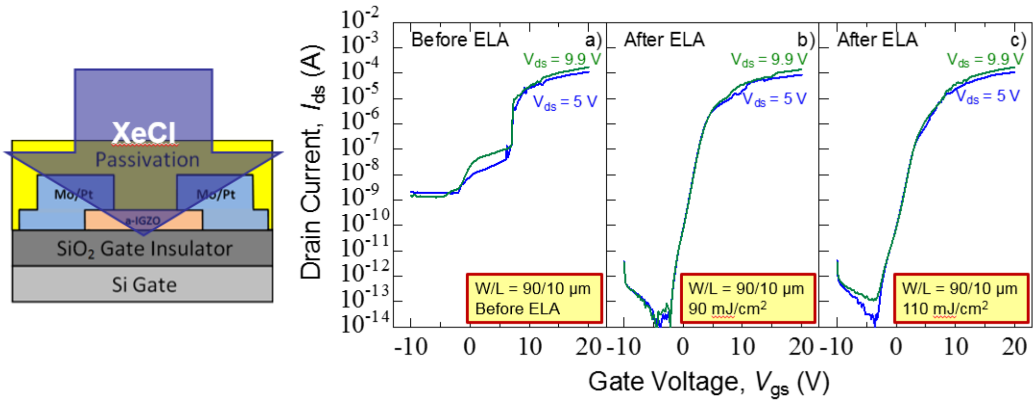

Fig.2 Excimer laser annealing for a-InGaZnO

References

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