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 drastically. 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 features which are not observed in conventional silicon materials. They are low fabrication temperature, high electrical performance or unique optical properties. To realize flexible devices with oxide thin film, several key issues should be discussed. In this talk, we will introduce several new techniques which are now being developed in our laboratory.

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

We demonstrate ELA on a-IGZO TFTs passivated with a hybrid passivation layer (Fig.1). 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. Highly doped n-type Si with 100 nm thermally oxidized SiO2 layer were used as the gate and gate insulator, respectively. A stack of 80 nm Mo and 20 nm Pt deposited by RF magnetron sputtering were used as source/drain electrodes. PSQ passivated TFTs were subjected to either 248 nm KrF ELA or 308 nm XeCl ELA at room temperature and atmospheric pressure. KrF ELA was performed under ambient atmosphere while XeCl ELA was performed under N2 environment. Note that ELA was performed after the passivation coating process. Since the PSQ passivation is transparent, we expect that the incident beam will be absorbed throughout the channel. Irradiating Me 100 samples with 90-110 mJ/cm2 XeCl ELA and Me 60/Ph 40 samples with 80 mJ/cm2 KrF ELA greatly improved the transfer characteristics and mobility (~13-18 cm2/Vs) (Fig.2).

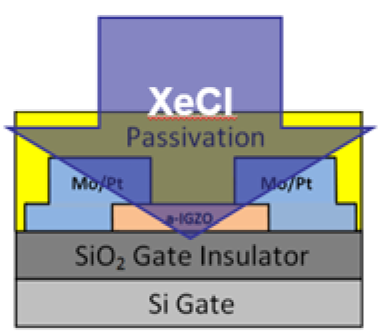

Fig.1 Excimer laser annealing for a-InGaZnO

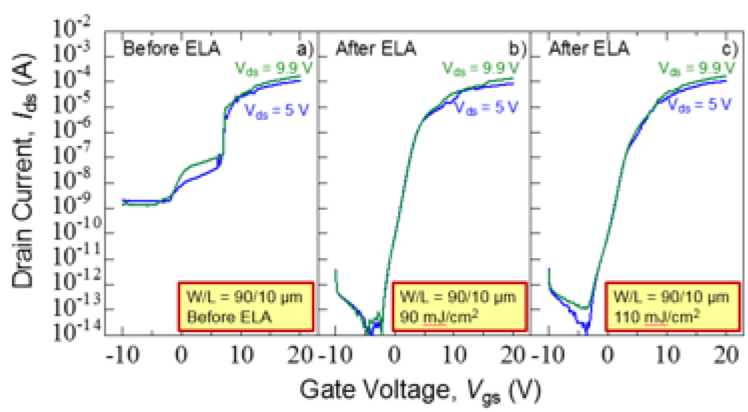

Fig.2 Excimer laser annealing for a-InGaZnO