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Research on the copper diffusion process in germanium metal induced crystallization by different thickness and various temperature

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Germanium (Ge) with higher carrier mobility and a lower crystallization temperature has been considered as the channel material of thin-film transistors for display applications. Various methods were studied for crystallizaion of poly-Ge from amorphous Ge at low temperature. Especially Metal induced crystalliazation (MIC) process was widely studied because low process cost.

In this paper, we investigate copper diffusion process of different thick (70 nm, 350 nm) poly-Ge film obtained by MIC process at various temperatures (250, 300, and 350°C) through atomic force microscopy (AFM), Raman spectroscopy, and secondary ion mass spectroscopy (SIMS) measurement. Crystallization completeness and grain size was similar in all the conditions. Copper diffusion profile of 370 nm poly-Ge film show simirly results regardless of process temperature. However, copper diffusion profile of 70 nm poly-Ge film show different results by process temperature.

Keywords: Copper, MIC, Crystallization

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The Effects of a Thermal Annealing Process in IGZO Thin Film Transistors

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In-Ga-Zn-O(IGZO) receive great attention as a channel material for thin film transistors(TFTs) as next-generation display panel backplanes due to its superior electrical and physical properties such as a high mobility, low off-current, high sub-threshold slope, flexibility, and optical transparency. For the purpose of fabricating high performance IGZO TFTs, a thermal recovery process above a temperature of 300°C is required for recovery or rearrangement of the ionic bonding structure. However diffused metal atoms from source/drain(S/D) electrodes increase the channel conductivity through the oxidation of diffused atoms and reduction of In_2O_3 during the thermal recovery process. Threshold voltage (V_{TH}) shift, one of the electrical instability, restricts actual applications of IGZO TFTs. Therefore, additional investigation of the electrical stability of IGZO TFTs is required.

In this paper, we demonstrate the effect of Ti diffusion and modulation of interface traps by carrying out an annealing process on IGZO. In order to investigate the effect of diffused Ti atoms from the S/D electrode, we use secondary ion mass spectroscopy (SIMS), X-ray photoelectron spectroscopy, HSC chemistry simulation, and electrical measurements. By thermal annealing process, we demonstrate VTH shift as a function of the channel length and the gate stress. Furthermore, we enhance the electrical stability of the IGZO TFTs through a second thermal annealing process performed at temperature 50°C lower than the first annealing step to diffuse Ti atoms in the lateral direction with minimal effects on the channel conductivity.

Keywords: IGZO, Thin Film Transistor, Metal diffusion, Recovery