The Electrical Characteristics of Polycrystalline Thin-Film Transistors Fabricated by the Thin Film Heaters

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The polycrystalline silicon thin film transistor (Poly-Si TFT) is widely used for devices of Active Matrix Liquid Crystal Display (AMLCD) or Random Access Memory (RAM). Because Poly-Si has a high electrical mobility compared with a-Si, it has many advantages to small device fabrication, high response rate TFT. Therefore, it has been investigated intensively to be replaced a-Si TFT process with poly-Si.

Crystallization from a-Si have many advantages over direct deposition of poly-Si because it use relatively low cost glass substrate. Therefore there have been lots of researches to develop a new process to crystallize from a-Si at relatively low temperature, Such as Excimer Laser Annealing (ELA), Metal Induced Lateral Crystallization (MILC), Rapid Thermal Annealing (RTA). We previously reported Solid Phase crystallization of a-Si deposited by LPCVD using $TiSi_2$ thin film heater. It has remarkable advantages over other low temperature processes such as abilities to anneal Si films at high temperature above 850¡É without any thermal deformations of glass substrate, because it has very low thermal budget.

In this work, we fabricated TFT's on solid phase crystallized Si by the thin film heaters mentioned above. And the electrical characteristics of TFT's were investigated.

500¡Ê-thick a-Si was deposited by LPCVD and patterned as active layer above thin film heaters, which was separated with SiO_2 layer from active layer. Gate Oxide was 800¡Ê-thick SiO_2 film deposited by PECVD, and sputter-deposited 3000¡Ê-thick Mo films were used as gate metal. film deposited at every step was patterned by lithography, so the channel width and length was varied from 5§- ~1000§-, 5§- ~ 20§-, respectively. After patterning of gate metals source and drain regions were doped by Phosphorous implantation at a dose of 3×10^{15} /§², and energy of 30keV. Subsequently, solid-phase crystallization of a-Si were conducted by the thin film heaters at various annealing conditions. And no other activation step was included.

The measurements of electrical properties of these TFT's showed higher electrical mobility and on/off ratio,120§²/Vs, 10^{-7}, respectively than other Low Temperature Si Processings (LTSP).

In conclusion, we successfully fabricated poly-Si TFT's by the thin film heaters, and we will show the superior electrical properties of it to other poly-Si TFT's.