The Electrical Characteristics of the Poly-Si TFTs fabricated by 2-Dimensional Grain Growing ELA method

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INTRODUCTION

Polysilicon thin-film technology is becoming increasingly attractive for active-matrix liquid-crystal displays (AMLCD’s) and other large-area electronic devices. (1) To achieve system on glass (SOG), high performance Si devices on a large glass substrate are necessary. The electrical characteristics of poly-Si TFT such as field-effect mobility and threshold voltage are dependent on the grain size and grain microstructure. (2) However, the grain size of poly-Si film recrystallized by conventional ELA may not be large enough for suitable device and circuit applications. (3)

EXPERIMENTS AND RESULTS

We have proposed a new ELA process employing floating active structure and multi channel structure. The proposed ELA method is illustrated in Fig. 1. It is well known that lateral temperature gradient in a melted Si film would induce the lateral grain growth. (4) In our proposed ELA method employing floating active structure and multi channel structure, temperature gradient is induced in two directions (x-axis, y-axis) so that 2-dimension grain growth occurs. Fig. 2 shows the transfer characteristics of the proposed poly-Si TFT. Field effect mobility of n-channel TFTs and p-channel TFTs are 571 cm²/Vs and 292 cm²/Vs, respectively. The high mobility value of the proposed TFT is due to the reduction of grain boundaries. To investigate reliability of the proposed poly-Si TFTs, the current source is biased at 1.2mA with grounded gate and drain electrode during 1000 seconds. Fig. 4 shows the electrical characteristics change during the stress time. In spite of high current exceeding 1mA, the proposed poly-Si TFTs is scarcely degraded due to the high quality grain structure. We have also fabricated CMOS inverter. Fig. 4 shows the electrical characteristics of CMOS inverter since inverters constitute the main parts of the peripheral circuit. A small signal gain within the transition region is very high due to high field effect mobility of the proposed poly-Si TFTs.

CONCLUSION

We have fabricated high performance poly-Si TFTs by a new ELA method that 2-dimensional grain growth can be produced. Under the high current stress exceeding 1mA, the proposed poly-Si TFTs are scarcely degraded. We have also fabricated CMOS inverter with high inverter gain.

References