Chapter 5

Conclusions

In this thesis, characteristics improvements of LTPS TFTs with CF_4 plasma treatment have been investigated for the first time. The CF_4 plasma treatment was carried out with CF_4 gas source by PECVD system at 350℃ and RF power of 5W-10W. The chamber pressure, CF_4 flow rate and treatment time was 200mTorr, 20sccm and 15sec, respectively. It can be seen that the electrical properties of the LTPS TFTs were promoted significantly. A steeper subthreshold slope, smaller threshold voltage, higher field effect mobility and better ON/OFF current ratio can be obtained for both SPC and ELA TFTs due to the reduction of the trap state density in poly-Si channel and SiO_2/poly-Si interface. Compared with the other fluorine incorporation methods published before such as fluorine ion implantation and fluorine in-situ doping from the fluorinated oxide (SiO_xF_y), our CF_4 plasma treatment is more process-compatible and simpler and just one plasma process is needed.

Furthermore, the reliability enhancements of poly-Si TFTs with CF_4 plasma treatment have been demonstrated by hot-carrier stress and self-heating stress. poly-Si TFTs with CF_4 plasma treatment always exhibit higher stress immunity and stability than conventional TFTs. It can be deduced that the incorporation of fluorine atoms by CF_4 plasma treatment not only passivates the dangling bonds and strain bonds but also forms strong Si-F bonds instead of weak SI-H and Si-Si bonds, thus raises the stress resistance of poly-Si TFTs.

Finally, the mechanisms of hot-carrier induced device degradation have been proposed by applying a various static stress conditions. We found that the ON and OFF current are strongly influenced by the applied static stress conditions and drain voltage of the I_{DS}-V_{GS} characteristics. This is due to different amount of charges trapping in gate insulator and trap states generation in poly-Si channel with applying different stress conditions. These results help us to understand more about the mechanism responsible for the hot-carrier degradation of poly-Si TFTs under static stress.

簡歷

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