

An Electrochemical Study on Copper Multi-Layer Wet Patterning in Phosphoric Acid Solution for LTPS and Metal-Oxide TFTs Application

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Abstract

Recently, a fabrication of ultra high definition (UHD) display using organic light emission display (OLED) has been actively studied by many researchers and thin film transistor companies. To overcome the RC delay issue and high electron mobility for high frequency driving UHD OLED display, low temperature poly-silicon (LTPS) or metal-oxide semiconductor combined with low resistive copper metallization is thought to be essential. Since copper has poor adhesion with underlying silicon oxide and easy diffusion into the oxide film, generally noble metals such as molybdenum and titanium are used to prevent both the diffusion and the delamination of the copper layer. In LTPS process, ion implantation followed by rapid thermal annealing about 500~600°C in a short time can cause a severe problem of oxidation of copper layer. It can be main reason for sudden drop in electrical resistivity of the copper layer after activation annealing process. Therefore, the triple layer structure of buffer layer/copper/buffer layer instead of Cu/buffer double layer is useful in gate electrode for LTPS. The wet etching behaviors of new molybdenum alloy/Cu/ Mo alloy tri-layers were investigated for the application of a gate electrode in low temperature poly-silicon. The tri-layers were patterned in a phosphoric acid based copper wet etchant. The new molybdenum alloy showed excellent wet patterning performances as 0.7 um in skew and 0.5 um tail due to reduced galvanic phenomena with copper layer in the wet etchant.