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Hillock Prevention of Al Thin Film on Glass Substrate Using Plasma Source Ion Implantation Technique

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Plasma source ion implantation, which uses a bulk plasma and high voltage pulsing technology, is a very promising technique to modify materials surface without affecting the bulk property. The areas of application include metallic surface modification to improve its wear and corrosion resistance, polymer surface modification to enhance the wettability, and semiconductor doping to form shallow junctions.

In plasma source ion implantation, the target to be implanted is immersed in a bulk plasma generated in a vacuum chamber and pulse-biased by successive negative high voltage pulses. The ions are extracted from the plasma and are accelerated in the sheath between the target and the plasma. They are implanted on the surface of the target with energies corresponding to the bias-voltage applied to the target. By this way, the uniform ion implantation all over the exposed surface can be achieved without necessitating the beam rastering or target manipulation.

In this study, plasma source ion implantation technique was used to prevent the hillock formation of aluminum thin film on glass substrate for TFT-LCD, where aluminum thin film is used as the gate material.

The samples used in the experiment were glass substrates coated with 2000 Å aluminum film. Nitrogen, oxygen, and carbon ion implantation were performed by using the plasma source ion implanter with energies of up to 60 keV. After ion implantation, the samples were heated up to 300 ℃ and air-cooled to room temperature. The surfaces of aluminum film were examined and depth-profiled with a scanning Auger electron microscopy to see the distribution of implanted ions. The oxygen-implanted sample showed no evidence of hillock formation. However, the energy and dose dependence were found. The sheet resistance was also measured to see the change after ion implantation.

In this talk, the application of plasma source ion implantation on TFT-LCD manufacturing process will be shown and the experimental results will be discussed.