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Plasma nitridation of atomic layer deposition-Al2O3 by NH3 in PECVD

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We have investigated the effect of plasma nitridation of atomic layer deposited-Al2O3 films of monocrystalline Si wafers and the thermal properties of nitridated Al2O3 films. Nitridation was performed on Al2O3 to form aluminum oxynitride (AlON) using NH3 plasma treatment in a plasma-enhanced chemical vapor deposition and it was conducted at temperature of 400°C with various plasma power condition. After nitridation, we performed firing and forming gas annealing (FGA). For each step, we have observed the minority carrier lifetime and the implied Voc by using quasi-Steady-State photoconductance (QSSPC). We confirmed a tendency to increase the minority carrier lifetime and the implied Voc after the nitridation. On the other hand, the minority carrier lifetime and the implied Voc was decreased after Firing and forming gas annealing (FGA). To get more information, we studied properties of the plasma treated Al2O3 films by using Secondary Ion Mass Spectroscopy (SIMS) and X-ray Photoelectron Spectroscopy (XPS).

Keywords: Nitridation, Aluminum oxynitride (AlON), NH3 plasma treatment, Aluminum oxide (Al2O3), plasma-enhanced chemical vapor deposition (PECVD)

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Characteristics of HfO2-Al2O3 Gate insulator films for thin Film Transistors by Pulsed Laser Deposition

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Hafnium oxide-aluminum oxide (HfO2-Al2O3) dielectric films have been fabricated by Pulsed Laser Deposition (PLD), and their properties are studied in comparison with HfO2 films. As a gate dielectric of the TFT, in spite of its high dielectric constant, HfO2 has a small energy band gap and microcrystalline structure with rough surface characteristics. When fabricated by the device, it has the drawback of generating a high leakage current. In this study, the HfAlO films was obtained by Pulsed Laser Deposition with HfO2-Al2O3 target(chemical composition of (HfO2)86wt%(Al2O3)14wt%). The characteristics of the thin Film have been investigated by x-ray diffraction (XRD), atomic force microscopy (AFM) and spectroscopic ellipsometer (SE) analyses. The X-ray diffraction studies confirmed that the HfAlO has amorphous structure. The RMS value can be compared to the surface roughness via AFM analysis, it showed HfAlO thin Film has more lower properties than HfO2. The energy band gap (Eg) deduced by spectroscopic ellipsometer was increased. HfAlO films was expected to improved the interface quality between channel and gate insulator. Apply to an oxide thin Film Transistors, HfAlO may help improve the properties of device.

Keywords: HfO2, HfAlO, ZnO, Oxide TFTs, IGZO