TiO_2Thin Film by Reactive Sputtering

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Thin film transistors (TFT) is a key devicefor large-area and high-definition display. Si-based inorganic insulating filmssuch as SiO_2 and SiN_x deposited by CVD (Chemical VaporDeposition) are generally used for the gate insulator of the TFT. Although CVDfilms are compact and robust, CVD is a concern for substrate contamination dueto high process temperatures and gas residue in the chamber. Due to the highprocess temperature of the chemical reaction of the gases, low temperatureprocesses are limited. However, PVD (Physical Vapor Deposition) enables todeposit the insulator at low temperature. The compound thin film can be formedby simultaneously flowing a reactive gas with the inert gas for the sputtering.If reactive gas is oxygen, oxide film is formed. The important factors for thefilm quality are substrate temperature, process pressure, applied voltage,distance between target and substrate, and gas mixing ratio. In this study,optimized process conditions of TiO_2 thin film was obtained byadjusting the reactive gas ratio to Ar and applied voltage. Also, theelectrical and morphological characteristics of the TiO_2 by reactivesputtering were investigated. For characterization, TiO_2 wasdeposited by reactive sputtering on a p-type silicon wafer. And then the Ti electrode was deposited withAr only without the reaction gas. The dielectric properties of TiO_2thin films were analyzed by capacitance-voltage (C-V) characteristics. Inaddition, leakage current and dielectric strength were analyzed through I-V curves.

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