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Current-voltage characteristics of $[Ta_2O_5]1\text{-}x\text{-}[TiO_2]x$ (x = 0.08) thin films

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MIS structures of $[Ta_2O_5]_{0.92}$-$[TiO_2]_{0.08}$ insulating films were prepared on Si (<100>, p- type) substrates, by RF sputtering method, at room temperature. Direct current (DC) conduction measurements on the prepared samples were carried out. Leakage current, at low electric field, was observed lower in the samples annealed at 150, 450 and 500 °C than the as- deposited and samples annealed at 350 and 400°C. The value of leakage current was found minimum 8.99 x 10^{-11} A, at 4.55 x 10^6 V/m (corresponding to 1.5 V) for samples annealed at 450°C. For all the present samples, breakdown was not observed in the measured applied voltage range, i.e., up to 2.42 x 10^7 V/cm. To determine the dominating conduction mechanisms, explicitly in different applied voltage ranges, characteristics of different possible conduction mechanisms were plotted. The dominating conduction may be determined by comparing the value of refractive index obtained from the slope of Schottky and Poole-Frenkel plots with the nopt. Concerning the leakage current, three main mechanisms have been invoked to explain the current transport in $[Ta_2O_5]_{0.92}$-$[TiO_2]_{0.08}$, i.e., Schottky emission, Poole- Frenkel effect, and space charge conduction.

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