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Annealing effects of aluminium silicate films grown on Si(100)

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The annealing effects of the thin aluminum silicate films grown on Si(100) by sputtering method was deeply investigated using various physical and electrical measurement methods. All the films grown at the temperature of 300℃ using sputtering Al_2O_3 target show amorphous structure as examined by x-ray diffraction and transmission electron microscopy. The amorphous structure is maintained up to 700℃ and then transformed to crystalline $Al_{1\,7}SiO_{0\,15}O_{2\,85}$ or mullite phase above the annealing temperature of 800℃. The conduction process, charge trapping and detrapping characteristics, and trap charge density in metal-oxide-semiconductor (MOS) structure are influenced by the annealing temperature. The depth profiling data using X-ray photo electron spectroscopy (XPS) show that the influences are closely related with the change of the interfacial layer and chemical state under the high temperature annealing. The breakdown characteristics are degraded after the annealing temperature of 900℃due to the rapid change of the interfacial layer thickness and chemical state of the silicate layer.