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Electric structure and thermal stability of $\text{HfO}_2\text{-Al}_2\text{O}_3$ (HfAlO) film for gate insulator

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Electric structure and thermal stability of an HfAlO gate dielectrics grown by atomic layer chemical vapor deposition were investigated using various measurement tools, such as XRD, XPS, TEM and electrical measurements. The amorphous structure of as-grown HfO_2 film was changed into poly crystal over the post annealing temperature of 750°C . Moreover, interfacial layer of SiO_2 was significantly increased over the temperature of 950°C . However, the incorporation of Al_2O_3 into the HfO_2 film improved the thermal stability, i. e. the growth of interfacial layer was effectively suppressed and structural charge was retarded over the annealing of temperature of 900°C . The electric structure was dominantly influenced by the incorporation of Al_2O_3 , resulting in the improved thermal stability. Another important finding was that accumulation capacitance was increased along with the increase of the annealing temperature, although serial capacitance would be decreased due to the increase of the interfacial layer. The structural information indicated that the molar volume change caused by the incorporation of Al_2O_3 was closely related to the increase of the accumulation capacitance.