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Hafnium Oxide Layer Based Metal-Oxide-Semiconductor (MOS) Capacitors with Annealing Temperature Variation

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Hafnium Oxide (HfOx) has been attracted as a promising gate dielectric for replacing SiO2 in gate stack applications. In this paper, Metal-Oxide-Semiconductor (MOS) capacitor with solution processed HfO2 high-k material as a dielectric were fabricated. The solvent using HfOCl2•8H2O dissolve in 2-Methoxy ethanol was prepared at 0.3M. The HfOx layers were deposited on p-type silicon substrate by spin-coating at 250°C for 5 minutes on a hot plate and repeated the same cycle for 5 times, followed by annealing process at 350, 450 and 550°C for 2 hours.

When the annealing temperature was increased from 350 to 550°C, capacitance value was increased from 337 to 367 pF. That was resulted from the higher temperature of HfOx which have more crystallization phase, therefore dielectric constant (k) was increased from 11 to 12. It leads to the formation of dense HfOx film and improve the ability of the insulator layer. We confirm that HfOx layer have a good performance for dielectric layer in MOS capacitors.

Keywords: MOS capacitor, Solution process, Hafnium oxide, annealing temperature

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MBE growth and magnetic properties of epitaxial FeMn2O4 film on MgO(100)

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FeM2X4 spinel structures, where M is a transition metal and X is oxygen or sulfur, are candidate materials for spin filters, one of the key devices in spintronics. Both the Fe and M ions can occupy tetrahedral and octahedral sites; therefore, these types of compounds can display various physical and chemical properties [1]. On the other hand, the electronic and magnetic properties of these spinel structures could be modified via the control of cation distribution [2, 3]. Among the spinel oxides, iron manganese oxide is one of promising materials for applications. FeMn2O4 shows inverse spinel structure above 390 K and ferrimagnetic properties below the temperature [4]. In this work, we report on the structural and magnetic properties of epitaxial FeMn2O4 thin film on MgO(100) substrate. The reflection high energy electron diffraction (RHEED) and X-ray diffraction (XRD) results indicated that films were epitaxially grown on MgO(100) without the impurity phases. The valance states of Fe and Mn in the FeMn2O4 film were carried out using x-ray photoelectron spectrometer (XPS). The magnetic properties were measured by vibrating sample magnetometer (VSM), indicating that the samples are ferromagnetic at room temperature. The structural detail and origin of magnetic ordering in FeMn2O4 will be discussed.

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