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Band alignment and optical properties of $(ZrO_2)_{0.66}(HfO_2)_{0.34}$ gate dielectrics thin films on *p*-Si (100)

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$(ZrO_2)_{0.66}(HfO_2)_{0.34}$ thin films as gate dielectrics have been proposed to overcome the problems of tunneling current and degradation mobility inachieving a thin equivalent oxide thickness. An extremely thin SiO_2 layer is used in order to separate the carrier in MOSFET channel from the dielectric field fluctuation caused by phonons in the dielectric which decreases the carrier mobility. The electronic and optical properties influenced the device performance to a great extent. $(ZrO_2)_{0.66}(HfO_2)_{0.34}$ dielectric films on *p*-Si (100) were grown by atomic layer deposition method, for which the conduction band offsets, valence band offsets and band gapswere obtained by using X-ray photoelectron spectroscopy and reflection electron energy loss spectroscopy. The band gap, valence and conduction band offset values for $(ZrO_2)_{0.66}(HfO_2)_{0.34}$ dielectric thin film, grown on Si substrate were about 5.34, 2.35 and 1.87 eV respectively. This band alignment was similar to that of ZrO_2. In addition, The dielectric function *$(\mathbf{k},\omega)$, index of refraction n and the extinction coefficient k for the $(ZrO_2)_{0.66}(HfO_2)_{0.34}$ thin films were obtained from a quantitative analysis of REELS data by comparison to detailed dielectric response model calculations using the QUEELS-$\varepsilon(\mathbf{k},\omega)$-REELS software package. These optical properties are similar with ZrO_2 dielectric thin films.*

Keywords: REELS; optical properties, and XPS