Al-Oxynitride interfacial layer investigations for PrO$_x$ on SiC and Si

PrO$_x$ is one of the candidates for both the realizing of further shrinking of EOT in microelectronic devices and electric field scaling at the interface between semiconductor and insulator in high power applications. However, the chemical reactivity of the PrO$_x$/SiC and PrO$_x$/Si interfaces causes a destructive interaction yielding silicate and graphite formation after direct deposition of PrO$_x$ onto SiC and Si, respectively. This leads to high leakage current values as well as to a limitation of the reduction of the EOT due to an interfacial layer with small permittivity values. Therefore we introduced an additional chemically inert layer. In previous studies we reported on spectroscopic investigations of Al-oxynitride (AlON), and we recognized a stable AlON/3C-SiC interface even for annealing steps up to 900°C.

In this contribution we will focus on the results of electrical characterizations of PrOx/AlON/Si stacks. We find a strong improvement in the leakage current by several orders of magnitude down to values of $10^{-7}$ A/cm$^2$ at an EOT of 4nm and interface state densities of mean values of $5\times10^{11}$/eVcm$^2$. We will also show comparisons of spectroscopic (XPS) investigations of thickness dependent PrO$_x$ series with and without AlON buffer layer, and will further discuss, if this buffer layer can improve the above mentioned EOT limitation. We also report on our ongoing electrical characterization of such stacks on SiC substrates.

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