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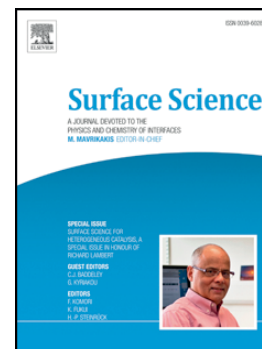
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Dependence of electrostatic potential distribution and alignment of $\text{Al}_2\text{O}_3/\text{Ge}$ structure on Al_2O_3 thickness

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Abstract: Electrostatic potential distribution and alignment of $\text{Al}_2\text{O}_3/\text{Ge}$ structure is investigated vs. Al_2O_3 thickness by X-ray photoelectron spectroscopy (XPS). The electrostatic potential distribution and alignment is found to be Al_2O_3 thickness dependent and the valence band offset increases with thicker Al_2O_3 . This interesting phenomenon is attributed to the appearance of gap states on Al_2O_3 surface ($\text{GS}_{\text{Al}_2\text{O}_3}$) and its higher charge neutrality level (CNL) compared with the CNL of gap states at $\text{Al}_2\text{O}_3/\text{Ge}$ interface ($\text{GS}_{\text{Al}_2\text{O}_3/\text{Ge}}$), leading to electron transfer from $\text{GS}_{\text{Al}_2\text{O}_3}$ to $\text{GS}_{\text{Al}_2\text{O}_3/\text{Ge}}$. In the case of thicker Al_2O_3 , fewer electrons transfer from $\text{GS}_{\text{Al}_2\text{O}_3}$ to $\text{GS}_{\text{Al}_2\text{O}_3/\text{Ge}}$, resulting in a larger potential drop across Al_2O_3 and XPS results.

Key words: band alignment; Electrostatic potential distribution; X-ray photoelectron spectroscopy; Germanium; high-k dielectric; charge neutrality level.

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