Epitaxial growth of β-Ga$_2$O$_3$ (-201) thin film on fourfold symmetry CeO$_2$ (001) substrate for heterogeneous integrations

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Two dimensional Silvaco Atlas TCAD simulation [1] was carried out to understand the spectral response of Ga$_2$O$_3$ thin film PDs grown on CeO$_2$. The band alignment of the β-Ga$_2$O$_3$ and CeO$_2$ are set exactly as in the Figure 4. (e). The schematic diagram of the simulated Ga$_2$O$_3$ thin film PD grown on CeO$_2$ is shown in Figure S1. (a). The thickness of the Ga$_2$O$_3$ and CeO$_2$ thin film are set to 300 nm and 20 nm, respectively. The spectral response at a bias of 5V when the beam intensity equals to 20 μW/cm$^2$ and 1 mW/cm$^2$ are shown in the Figure S1. (b) and (c). Based on our simulation result, the spectral response only shows a single peak around 250 nm when the beam intensity equals to 20 μW/cm$^2$, which agrees with our experimental result. This behavior could be explained by the thickness of the CeO$_2$ thin film is much less than the above Ga$_2$O$_3$ film. Moreover, by artificially increasing the beam intensity to extremely large value (1 mW/cm$^2$), we can see that an additional peak around 350 nm comes out. Thus, we conclude that only the peak of Ga$_2$O$_3$ in our simulated PD spectral response can be observed when the beam intensity equals to 20 μW/cm$^2$.

![Figure S1](image)

Figure S1. (a). Schmatic diagram of the simulated Ga$_2$O$_3$ thin film PD grown on CeO$_2$. (b). The spectral resone at a bias of 5 V under the beam intensity equals to 20 μW/cm$^2$. (c). The spectral resone at a bias of 5 V under the beam intensity equals to 1 mW/cm$^2$.

Reference