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# THERMAL STABILITY OF IN-SITU ALUMINA/TITANIA STACKS FOR BORON EMITTER PASSIVATION ON N-TYPE SILICON SOLAR CELLS

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$Al_2O_3/TiO_2$ stacks formed by atomic layer deposition are known to provide a high level of passivation for boron-doped silicon. In previous works, the $TiO_2$ layer was deposited on a pre-annealed $Al_2O_3$ layer, however this stack showed passivation degradation after post-deposition annealing. This work presents an alternative to using the as-deposited $Al_2O_3$ for the $Al_2O_3/TiO_2$ stack, which shows no degradation of passivation after post-deposition annealing up to 400°C. This approach simplifies the processing, allowing continuous layer deposition, and eliminates the undesirable vacuum breaking. This simplified processing leads to better thermal stability of the $Al_2O_3/TiO_2$ stacks and a low emitter saturation current density. In order to understand the underlying mechanism of surface passivation, an investigation on the effect of thermal $SiO_2$ on the passivation of the Al2O3/$TiO_2$ stack was performed, which indicates that the $TiO_2$ capping layer enhances the field-effect passivation for both the Si/$Al_2O_3$ and $SiO_2/Al_2O_3$ structure.

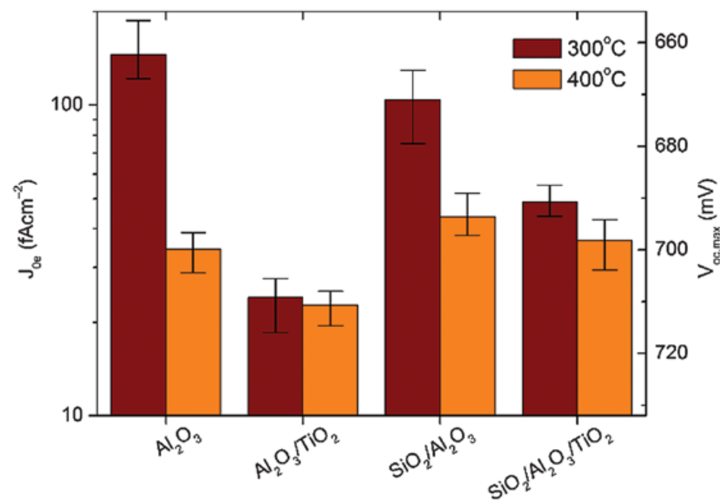


Figure 1: Emitter saturation current density of $Al_2O_3$ single layer- and $Al_2O_3/TiO_2$ bilayer-passivated silicon with/without thermal $SiO_2$ interfacial

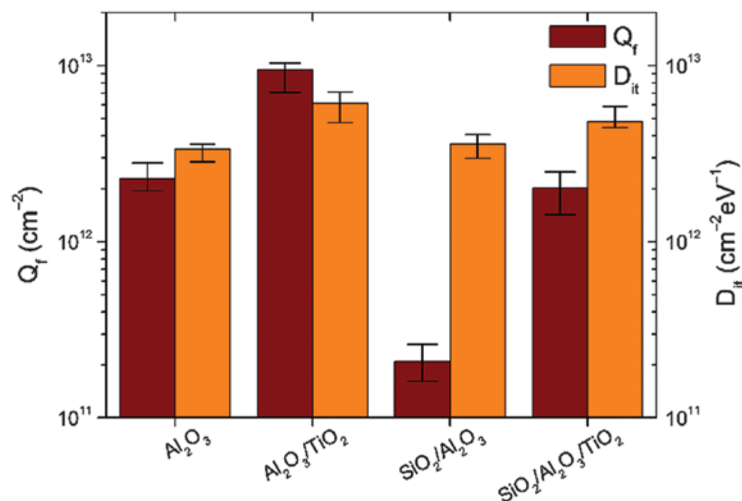


Figure 2: Fixed charge density ($Q_f$) and interface trap density ($D_{it}$) at midgap based on C–V results of metal-oxide-semiconductor capacitor for single $Al_2O_3$ layer- and $Al_2O_3/TiO_2$ bilayer-passivated silicon with/without thermal $SiO_2$ interfacial layer after 400 °C