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Evidence for the Potential Barrier Height Reduction in Metal-Oxide-Metal Tunnel Junctions due to the Interface Dependent Metal-Induced-Gap-States

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We have performed transport measurements on Al and Nb based metal-oxide-metal tunnel junctions with an AlO$_x$ tunnel barrier and found a strong dependence of the effective potential barrier height on the oxide-metal interface properties. Our estimations of the barrier height based on a phenomenological Simmons’ model are consistent with the values obtained from the first-principle calculations. The calculations clearly show that the barrier height is strongly affected by the formation of metal induced gap states originating from the hybridization between metallic bands and Al$_2$O$_3$ conduction band. These findings are important for nanoelectronic devices containing tunnel junctions with a thin insulating layer.

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