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Supplementary Information

Design principle for p-type oxide gate layer on AlGaN/GaN toward normally-off HEMTs: Li-doped NiO as model †

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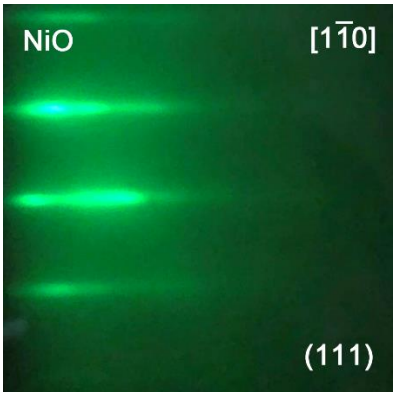

Fig. S1. RHEED pattern of NiO thin films on Al_2O_3 substrates.

Fig. S1 shows the RHEED pattern of NiO thin films on Al_2O_3 substrates. The above similar RHEED pattern with NiO on GaN indicates the similar epitaxial crystal structure of NiO thin films on GaN and Al_2O_3 substrates.

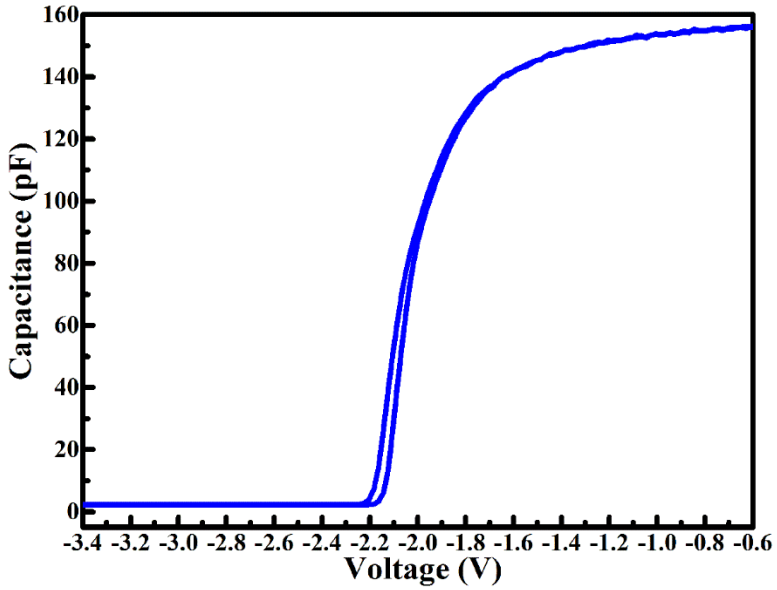

Fig. S2. C-V characteristic of Pt/$Ni_{0.75}Li_{0.25}O$/AlGaN/GaN/Si heterostructure.

Fig. S2 displays C-V curve of Pt/$Ni_{0.75}Li_{0.25}O$/AlGaN/GaN/Si heterostructure. The small voltage window indicates good interfacial state at $Ni_{0.75}Li_{0.25}O$/AlGaN interface.

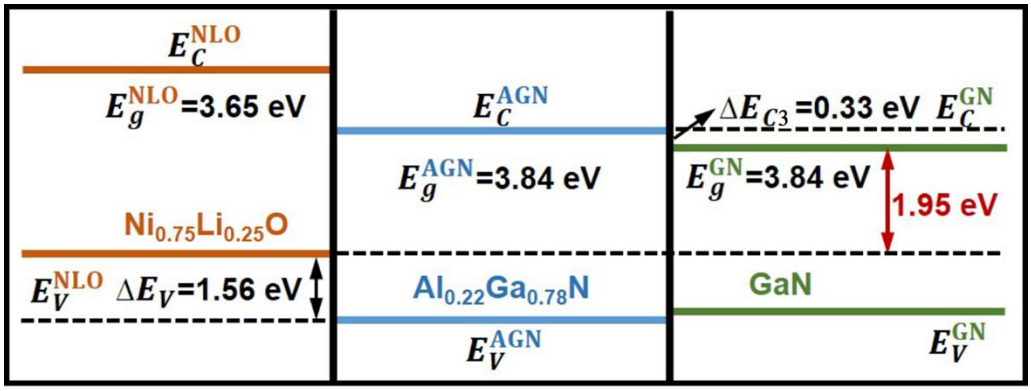

Fig. S3. Band alignment of $Ni_{0.75}Li_{0.25}O/Al_{0.22}Ga_{0.78}N$/GaN heterostructure.

Fig. S3 shows the band alignment of $Ni_{0.75}Li_{0.25}O/Al_{0.22}Ga_{0.78}N$/GaN heterostructure. The ratios of conduction band discontinuities to valence band discontinuities are 75:25 for AlGaN/GaN interface in the reported results.[36] Thus the valance band offset (ΔE_{C3}) value at $Al_{0.22}Ga_{0.78}N$/GaN interface is calculated to be 0.33 eV. Therefore, intrinsic $E_C^{GaN} - E_V^p$ value is determined to be 1.95 eV calculated by $E_g^{AGN} - \Delta E_V - \Delta E_{C3}$.