DLTS, admittance spectra and EBIC studies of NiO/Ga2O3 heterojunctions: comparison to Schottky diodes

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NiO/b-Ga2O3 heterojunctions are arising interest for use in power rectifiers operating in multi-kV voltage range. In our work we fabricated p-NiO/b-Ga2O3 HJs by deposition of NiO films prepared by IBS on n-/n+(001) oriented b-Ga2O3 heterostructures grown by HVPE on EFG substrates. The results of I-V, C-V, C-f, AS, DLTS, EBIC studies are compared to those obtained on Ni Schottky diodes prepared on the same structures.

In HJs, in contrast to SD, the AS spectra show the presence of a set of prominent steps /peaks characterized by the activation energy of 0.17 eV, with another set of steps/peaks at lower temperatures (Fig. 1). No such features are present in the SD. In DLTS spectra the SD display peaks due to the E2* and E2 traps. In HJs the E2* trap is strongly suppressed which correlates with a higher diffusion length of charge carriers compared to SD (370 nm versus 240 nm). At low temperatures observe a hole-trap-like feature near the shallow electron traps feature, both manifestly absent in SD (Fig. 2). We discuss the possible nature of the processes giving rise to the observed AS features: a strong freeze-out of holes in p-NiO, possible Schottky-type behavior of the Ni/NiO contact, possible role of interface traps. We also discuss possible role in the observation of the hole-trap feature in DLTS of the strong capacitance freeze-out at low temperatures.

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