Investigation of Schottky contacts and traps in β-Ga_2O_3

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Beta-phase gallium oxide (β-Ga_2O_3) is an ultra-wide bandgap (UWBG) semiconductor that is promising for a broad range of applications including power electronics and chemical sensing, but the understanding of this material is still in its infancy. β-Ga_2O_3 is attracting particular interest due to its large, direct bandgap of ~ 4.8 eV, the availability of *n*-type doping, the ability to create heterostructures, and the availability of native substrates to support homoepitaxial growth. Additionally, several groups have reported promising initial results with high breakdown voltage transistors demonstrating the promise of this material [1-3]. However, there has been little research so far to understand the source and concentration of defects or their impact on device behavior so far [4]. Additionally, the properties of Schottky contact metals are not well explored, but is essential for metal semiconductor field effect transistors (MESFET) and similar devices. This presentation will focus on characterization of defects in β-Ga_2O_3 (Fig. 1), exploration of Schottky barrier heights for Ni, Au, Pt, and Pd metals (Fig. 2) using internal photoemission, capacitance-voltage, and current-voltage-temperature (I-V-T) measurements, and the carrier transport in the Schottky contacts using I-V-T.

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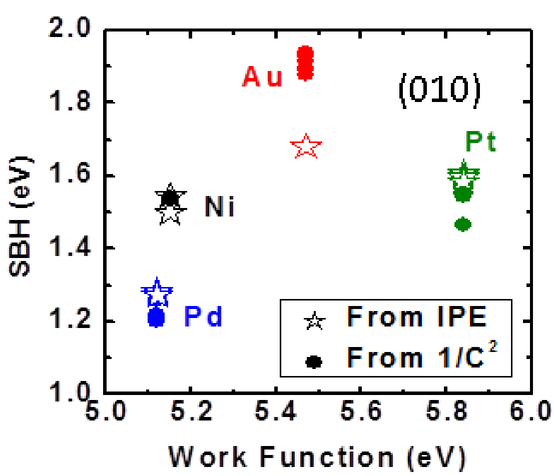

Figure 1: Measured Schottky barrier heights vs. metal work function for Pd, Ni, Au, and Pt/(010) β-Ga_2O_3.

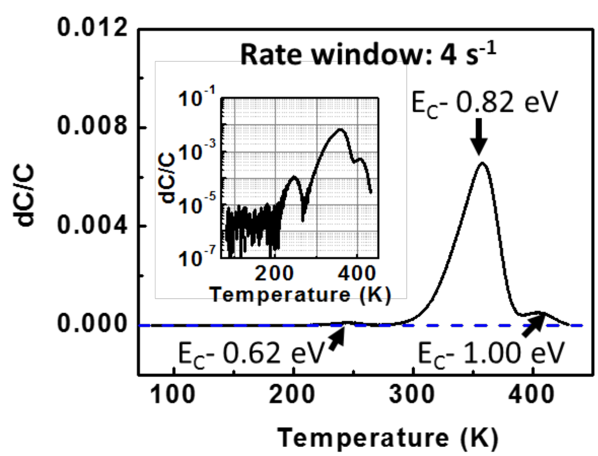

Figure 2: Deep level transient spectroscopy spectrum of bulk (010) β-Ga_2O_3. The traps were observed (E_C-0.62, E_C-0.82 and E_C-1.00 eV) where the EC-0.82 eV trap with the highest concentration was $3.5x10^{16}$ cm^{-3}.