INVESTIGATION OF ULTRA-LOW CONTACT RESISTIVITY FOR InP BASED DHBTS

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Heterojunction bipolar transistors (HBTs) are promising electronic devices that are used in applications such as radar and communication technology. To increase f_max and f_τ, very low contact resistivity is required.

Methods

The samples were grown in a 6x2" close coupled showerhead MOVPE from AIXTRON utilizing only non-gaseous precursors. The nominal doping of the samples (n-doped $In_{0.53}Ga_{0.47}As$) was ~2.5E19 cm-3. Deposition occurred in an oxygen-isolated environment. The initial experiment is concentrated on evaluating the impact of various contact metals on contact resistance, selecting titanium (Ti), platinum (Pt) and palladium (Pd) as contact metals to be deposited onto the InGaAs mesa. Subsequently, we investigated the influence of argon plasma as a surface treatment method for the Ti-InGaAs contact.

Results

Figure 1a illustrates the deposition apparatus, isolated from oxygen by a glovebox. Figure 1b indicates that contacts with palladium exhibited the lowest contact resistivity, with a value of 2.4E-8 Ωcm2. Following this, titanium was selected as the contact metal, and prior to deposition, the wafer surface was treated with argon plasma. The results, presented in figure 1c, show that reducing the acceleration voltage results in improved contact resistivity, with titanium's contact resistivity decreasing from 4.2E-8 Ωcm2 to 1.7E-8 Ωcm2 at an acceleration voltage of 50 V.

Conclusion

This study demonstrates the role of contact metal selection and surface pre-treatment in minimizing HBT contact resistivity. Palladium emerged as the most effective contact metal, likely due to its oxygen desorption properties. Argon plasma pre-treatment significantly improved titanium's contact resistivity.