Supplementary information: Quantitative characterization of built-in potential profile across GaAs p-n junctions using Kelvin probe force microscopy with qPlus sensor AFM

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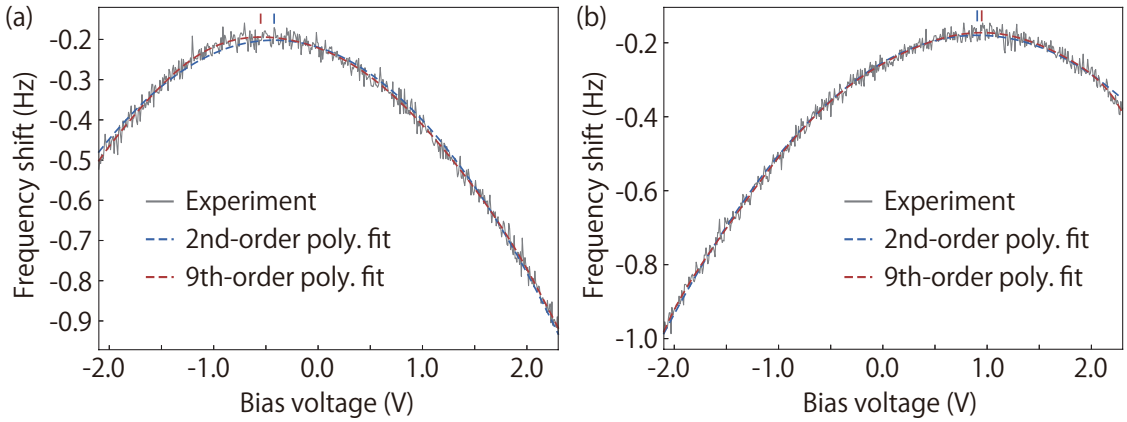

FIG. S1: Δf–U spectra obtained at (a) n- and (b) p-type regions and the fitting curves using 2nd- and 9th-order polynomials. The vertical lines indicate the inflection points of each polynomial.

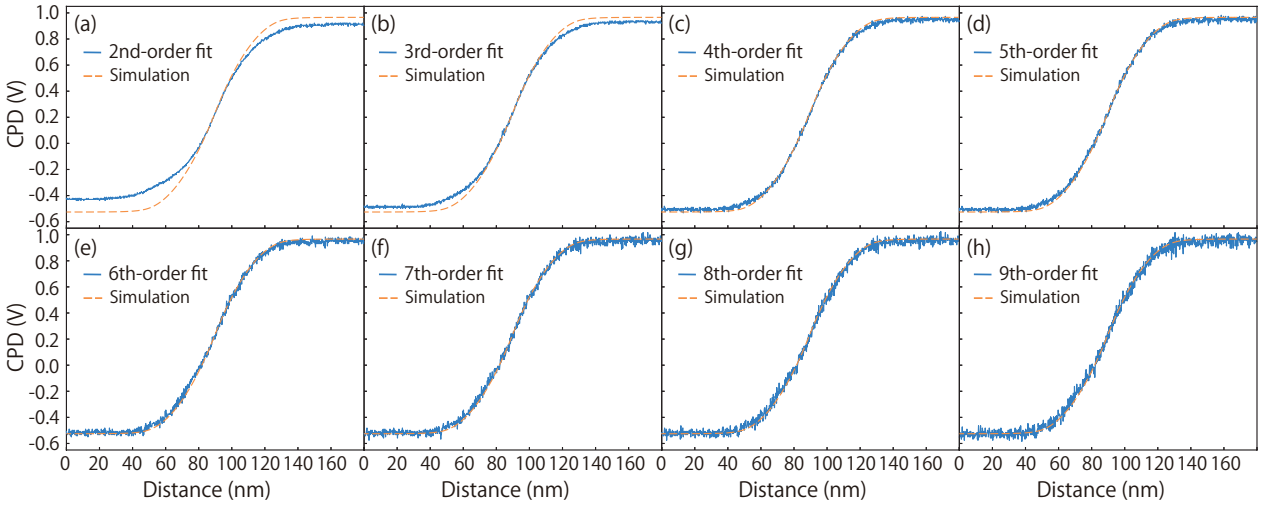

FIG. S2: Dependence of the CPD profiles across the p-n junction on the order of the polynomial used for fitting.

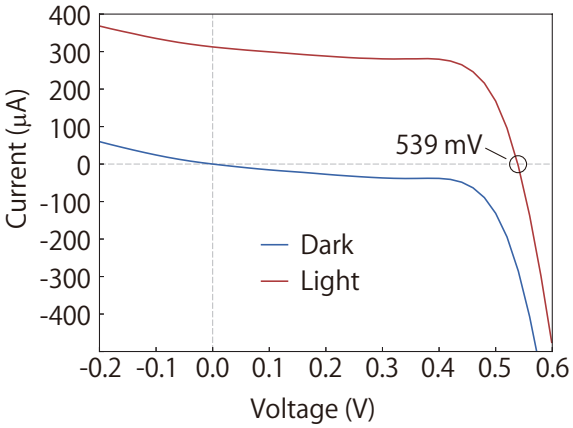

FIG. S3: Current-voltage characteristics of the p-n diode obtained under dark and light-irradiation conditions. Rectification characteristics of the diode were observed. The open circuit voltage measured from the X-intercept of the curve was 539 mV.

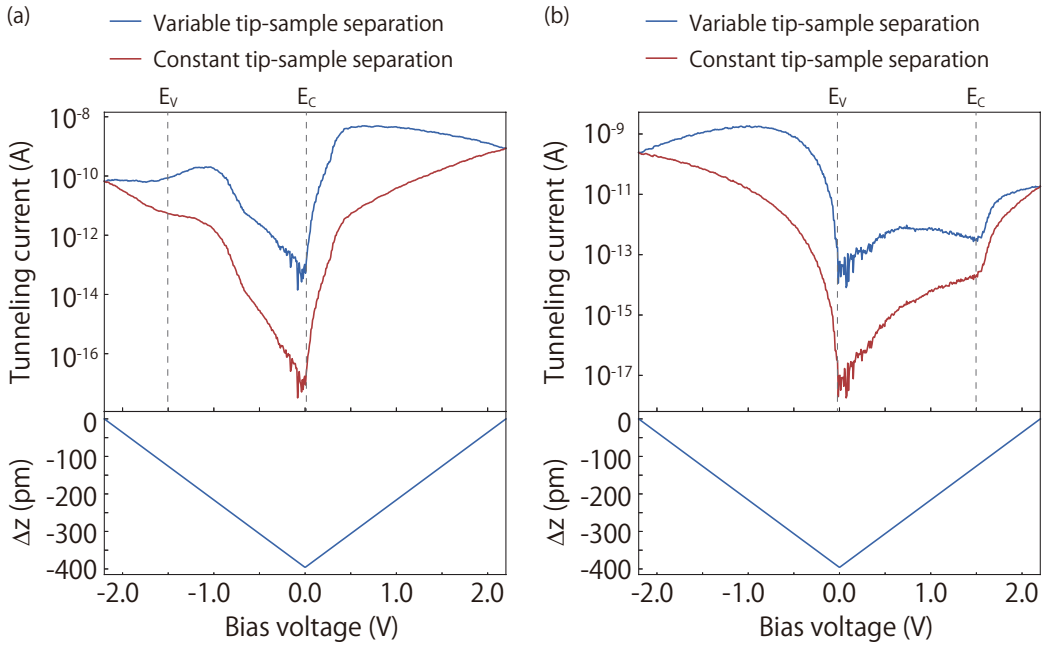

FIG. S4: I_t–U spectra obtained with the variable tip-sample separation technique and the spectra converted to the constant tip-sample separation, obtained at (a) n-type and (b) p-type regions. The bottom graphs show the bias dependent offset of the tip-sample separation (Δz). The offset has the form $\Delta z(U) = a|U|$ where U is the bias voltage. Proportionality coefficient, a, was 180 pm/V for both positive and negative bias voltage. The vertical dashed lines indicate the theoretical positions of the band edges. The onset of the conduction (valence) band component for the n-type (p-type) region coincided well with the position of E_C (E_V). In contrast, the onset of the valence (conduction) band component in the n-type (p-type) layer deviated slightly from the band edges by 50-100 mV. This small deviation was induced by the relatively small current component, called dopant-induced component (D-component) observed in the band gap region. The valence (conduction) band component in the n-type (p-type) layer began to appear only when these components became larger than the D-component. Thus, the apparent onsets shifted from the actual positions. The onset position for the n-type layer was not clear due to the relatively large D-component.