Interlayer Resistance Variations Resulting from Conductive Channel Migration in Multilayer WSe_2 Field-Effect Transistors

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Conducting channel migration in two-dimensional van der Waals multilayers along the thickness has attributed to numerous parameters, such as contact resistance, thickness-dependent carrier mobility, distribution of surface trap density, and the Thomas-Fermi screening length effect. Nevertheless, the precise direction of channel migration with the effects of interlayer resistance on the carrier density under different electrostatic drain and gate bias conditions have not been clearly resolved yet. In this poster, we present the direction of channel migration and the resultant negative differential interlayer resistance (NDIR) triggered by the vertical channel migration of a multilayer WSe_2. The electrostatic bias-dependent shape variation of transconductance is closely related to carrier transport in 2D multilayers, and clearly illustrates the redistribution of the carrier density profile with diverse contact electrode configurations: i) bottom-contact (BC), ii) top-contact (TC), and iii) vertical double-side contact (VDC)[1]. In addition, by employing a conventional four-probe measurements to exclude the contact resistance, we found that the reversal of the conducting channel migration direction probed via VDC contributes to the presence of negative differential interlayer resistance within 2D WSe_2 multilayers. Our results provide insights into an advanced device layout and profound understanding of the distinct carrier transport mechanism in 2D multilayers.

References

[1] Chae, M.; Han, Y.; Park, Y. H.; Choi, D.; Choi, Y.; Kim, S.; Song, I.; Ko, C.; Joo, M.-K., *ACS Appl. Mater. Interfaces*, **2023** *15* (19), 23439–23446.

Figures

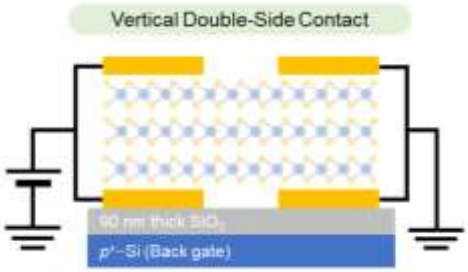

Figure 1 : Device structure of a multilayer WSe_2 based FET with Vertical Double-Side Contact