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Two-dimensional van der Waals Heterostructures for Device Applications

Graphene has brought a great deal of excitement to nanoscience community with its attractive and unique properties. Such excellent characteristics have triggered highly active researches on other 2D materials. These emerging 2D materials are promising candidates for flexible and transparent electronics. Furthermore, new physics observed in 2D materials allow for development of new-concept devices by using their valleys, tunneling effect, photoluminescence, and optical responsivity. Recently, vdWHs have been achieved by putting these 2D materials onto another, in the similar way to build Lego blocks. This enables us to investigate intrinsic physical properties of atomically-sharp heterostructure interfaces and fabricate high performance optoelectronic devices for advanced applications. In this talk, I will briefly introduce critical issues to be resolved for practical applications of 2D materials, including contact resistance, environmental sensitivity, coupling at interfaces, and surface modification.[1-3] Recently, we have shown how to solve these problems to improve the device performance of 2D materials. Further, we demonstrated high performance electronic devices consisting of vdWHs, such as transistors, memories, strain sensors, and solar cells.[4-8] Our approaches would allow us to come closer to practical applications of 2D materials in industry.

References

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Figures

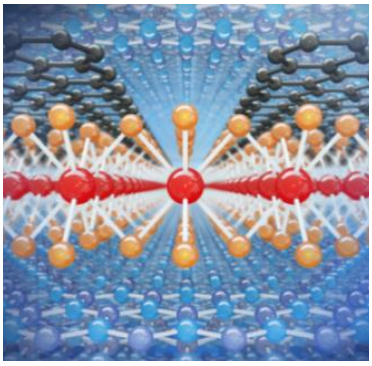

Figure 1: Schematic of vdWHs