Nanofabrication and Characterization of Thin-Film Devices

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ABSTRACT

My academic background is in semiconductor physics and nanomaterials synthesis, where I gained immense experience in the preparation and characterization of metal oxides for use in optoelectronic and renewable energy applications. During my MPhil research and later independent research work, I worked on sol-gel synthesis, thin-film processing, as well as analytical methods such as XRD, SEM, UV-Vis, FTIR, EIS, and electrochemical testing [1,2]. These experiences helped me to understand how small changes in the structure of the materials can have strong impacts on device performance, and inspired me to look at nanomaterials beyond synthesis to real device fabrication. This interest prompted me to work in the Nanodevice Physics Laboratory of Prof. Wei-Hua Wang, a research unit that works on nanoscale device engineering and interface-controlled 2D materials. Specifically, the latest success of the group, which is the synthesis of slanted-angle etched monolayer MoS2 transistors to fabricate (contact) resistant edges, illustrates how established limitations in contact resistance can be circumvented through superior nanofabrication methods and allow the creation of improved electronics [3]. Such innovation guided me towards the realization that fabrication was a very accurate method of unlocking the physics of a device. My present research focuses on acquiring the fabrication process and procedures that define the quality, reliability, and performance of nanoscale devices. The processes that govern the performance of a device are pre-patterning, e-beam lithography, and thin-film deposition. At the nanoscale, even a very small difference in surface adhesion, pattern alignment, or geometry of contact may lead to drastic changes in system conductivity, switching behavior and system efficiency. By gaining skills in these processes, I am getting to understand how to manipulate the variables that directly affect the results of science. This fundamental education is the foot in the door to the work of the next generation devices, with an increased resolution in fabrication will enable faster electronics, less power consumption, and entirely new forms of devices based on 2D material.

REFERENCES

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