

Soft Stamp Transfer of Vertical Layered Heterostructures

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Abstract

Van der Waals heterostructures (vdWH) are monolayer materials (e.g., graphene, hBN) and transition metal dichalcogenides (TMDs, e.g., MoS₂, WS₂) that can be vertically stacked on top of each other. These vdWH materials hold immense potential to revolutionize the field of nanoelectronics, promising advancements in transparent displays, sensor arrays, and logic and memory circuits. However, the current method of assembling vdWH devices, which relies on manual operation, is lacking due to its imprecision and unrepeatability. The broad scope of the Warner lab is to remove these technical barriers concerning vdWH materials, first by characterizing the interfacial adhesion between the different aspects of the stamp transfer process (e.g., stamp, vdWH materials, and substrates), next, by creating an automated soft-robotic stamp transfer machine that takes into account the interfacial adhesion and necessary temperatures, and finally by creating metrology and data analysis tools in order to improve the manufacturing process. This project will focus on square one: being able to repeatedly and with precision, transfer different vdWH materials manually, and learning about the characteristics of each aspect along the way. This project will explore the methods and approaches to transferring different vdWH materials, bulk layering different vdWH materials, and exploring the impacts of various temperatures on both the pick-up and release processes. The following steps for the project include navigating the process of transferring and layering vdWH materials onto a TEM grid using the skills gained throughout the semester. This process requires high precision and deliberation to avoid breaking the delicate window of the TEM grid.

Biography of Presenter

Grace McAloon is currently a first-year Mechanical Engineering Honors student at the University of Texas at Austin. She is an undergraduate researcher in Dr. Jamie Warner's lab. McAloon is also active in the American Society of Mechanical Engineers (ASME) and will be the 2024-2025 Events Coordinator Officer. McAloon is a Student Consultant for the Division of Vice-President of Student Affairs and a Student Dining Assistant/Barista at the Littlefield Patio Cafe. She will participate in the McCombs Summer Institute (MSI) in the summer, where she will finish her business minor. McAloon is also working towards a government minor. She plans to one day attend law school and become a patent attorney. She also plans to continue researching if she can at the Warner lab, where she is currently working toward being able to repeatedly transfer materials on a TEM grid.

