Two-dimensional Materials: Films and Lattices

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Two-dimensional (2D) materials, such as graphene, are thin-layered materials consisting of a single or a few layers of atoms. 2D materials are attractive for their potentially diverse applications in key technological areas due to their unique properties in terms of electrostatic efficiency, mechanical strength, tunable electronic structure, and optical transparency. Isolation/synthesis of graphene from its precursor some twenty years ago has opened the door for the discovery and exploration of other emerging 2D materials; more than 2,000 of them that can be easily exfoliated have been discovered or synthesized to date, and yet their physical and chemical properties are largely unexplored. In this talk, we focus on studying the mechanical properties of thin films of $Ti_3C_2T_x$ MXene where *Ti* is titanium, *C* is carbon, and *T* represents a terminal group. Effect of fabrication technique, size (thickness), strain rate, as well as annealing temperature on the mechanical behavior of MXene thin film will be reported. In addition, we will also report the durability of MXene composite film under moisture environment for the purpose of effective electromagnetic interference (EMI) shielding. Subsequently, we have fabricated lattices made of 2D materials and their mechanical and thermal behavior will be discussed.