ABSTRACT:

Going Beyond the “Givenness” of Deposited Thin Films and Two-Dimensional Structures: Spalling and Direct-Write CVD Methods for Integrating New Electronic Materials.

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Quantum information technology and microelectronics needs have pushed forward a handful of hard, brittle, or refractory materials to the foreground of solid-state materials research the past two decades. Recent research has been underway to develop new methods to integrate these materials with existing semiconducting platforms without trying to deposit one layer upon another (heteroepitaxy). Integrating three-dimensional structures by introducing additive deposition methods, as opposed to subtractive lithographic methods have also received increasing recent interest. In this talk I will describe ongoing experiments in my group aimed at these objectives. (i): the spalling of “hard” materials such as SiC, and diamond; and oxides such as LiNbO3 and CaWO4 where large (up to wafer size) layers that are few to 10s of microns thick can be peeled oW via a stress and fracture initiation process from bulk wafers without any heat treatment or ion implantation. (ii): our work on “near field direct-write” physical (and chemical) vapor deposition with a goal of writing structures in three dimensions and—eventually--deterministically being able to place qubits on a surface. My talk will focus on the materials science aspects of these experiments, and I will address both the “good news” and the bad.