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Semiconductor Characterization: from Growth to Manufacturing

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The successful growth and/or deposition of materials for any application require basic understanding of the materials physics for a given device. At the beginning, the first and most obvious characterization tool is visual observation; this is particularly true for single crystal growth. The characterization tools are usually prioritized in order of ease of measurement, and have become especially sophisticated as we have moved from the characterization of macroscopic crystals and films to atomically thin materials and nanostructures. While a lot attention is devoted to characterization and understanding of materials physics at the nano level, the characterization of single crystals as substrates or active components is still critically important. In this presentation, I will review and discuss the basic materials characterization techniques used to get to the materials physics to bring crystals and thin films from research to manufacturing in the fields of infrared detection, non-volatile memories, and transistors. Finally I will present and discuss metrology techniques used to understand the physics and chemistry of atomically thin two-dimensional materials for future device applications.