Metalorganic Vapor Phase Epitaxy: From Bulk Films to Atomically Thin Layers

Zakaria Al Balushi
Department of Materials Science & Engineering
University of California, Berkeley

Abstract: The development of wide bandgap group-III nitrides (AlN, GaN, and InN) thin films and device structures by metalorganic vapor phase epitaxy, is an area of continuing research that is aided by the extensive use of in situ optical characterization techniques. These compound semiconductors were key to the realization of efficient light emitters (visible and UV), robust high-frequency power electronics and other disruptive technologies that now have become truly ubiquitous. In order to shape next-generation technologies, innovative research must be undertaken to extend the properties of such materials beyond what is currently possible. This "extension" may be realized through extreme confinement of these materials in two-dimension, leading to massive changes in electronic bandstructure with as-yet unpredicted properties. To accomplish this, an alternative growth scheme was developed to realize two-dimensional forms of conventional bulk semiconductors, utilizing the mechanism of adatom intercalation from the vapor phase in the growth environment into the interfacial region of graphene formed on SiC. This synthesis process, referred to as "Migration Enhanced Encapsulated Growth" (MEEG), establishes an entirely new platform to realize tunable optoelectronics that may frame next-generation technology.

Bio: Zakaria (Zak) Al Balushi is currently Assistant Professor of Materials Science and Engineering at UC Berkeley. Zak joined the Atwater group in 2017 as a Resnick Prize Postdoctoral Fellow in Applied Physics and Materials Science. Prior to joining the Atwater group, Zak received his Ph.D. in Materials Science and Engineering (2017), his M.S. (2012) and B.S. (2011) in Engineering Science all from The Pennsylvania State University. During his graduate work, Zak focused on MOCVD growth, characterization and integration of electronic and photonic materials from thin films to atomically thin layers. At Caltech, his research focused on band alignment in two-dimensional and layered materials in order to design new heterojunctions for photonic and optoelectronic devices.
(Taken from Atwater Website)