

# Synthesis and Characterization of 2D Materials and Heterostructures

**Ariel Ismach**

*Department of Materials Science and Engineering, Tel Aviv University,  
Email: [aismach@tauex.tau.edu.il](mailto:aismach@tauex.tau.edu.il), Web: <https://english.tau.ac.il/profile/aismach>*

## Abstract

The interest in 2D layered materials has been renovated with the successful isolation of single- and few-layer graphene in 2004 and the elucidation of its outstanding electronic properties. Since then, the research on graphene and other atomic-films has been exponentially increased and new interesting phenomena and applications were demonstrated. The intense study of the growth mechanism of graphene has enabled today the growth of millimeter-size single-crystal and single-layer graphene domains, a very important milestone towards integration in new and existing technologies. This was achieved by understanding the basic processes taking place during the growth. While the ability to synthesize large-area and high quality atomic films is a prerequisite for their successful integration into a wide variety of applications, little is known about the growth mechanism of other 2D materials.

In this talk, I will describe our attempts to achieve large-scale synthesis of 2D materials in general with emphasis on transition metal dichalcogenides (TMD). I will start by reviewing current methodologies for the synthesis of TMD films, with emphasis on chemical vapor deposition, due to its proven record with graphene and other 2D materials. Then I will cover our modifications to such methodologies in order to achieve better homogeneity and control, including the use of volatile precursors and the development of a seeded-growth approach. Beside planar films, the formation of 3D structures, few-layer graphene/TMD heterostructures, will be discussed, from the synthetic and applications point of view.

## Short Biography

Dr. Ariel Ismach holds a BEng in Materials Engineering from Ben Gurion University of the Negev, and an MA and PhD in Materials and Interfaces from the Faculty of Chemistry, Weizmann Institute. He was awarded a prize from the Israel Chemistry Society for his doctoral thesis. In 2009 he moved to Berkeley for a joint post-doctoral position at the Department of Electrical Engineering, University of California–Berkeley and the Materials Science Division of the Lawrence Berkeley Laboratory. In 2011 he joined the group of Prof. Ruoff in the department of Mechanical Engineering, at the University of Texas in Austin, where he led a small group of Ph.D. students and postdocs researching the growth and characterization of various 2D materials. He joined the Materials Science and Engineering department at Tel Aviv University in October 2014 where he had established a laboratory dedicated to study the growth and properties of 2D atomic-crystals. His group is working to address basic scientific questions regarding the formation and the structure-property relationship of 2D materials as well as developing new methodologies to engineer such layered materials and their heterostructures for applications in catalysis, energy storage and photovoltaics.

