Synthesis and Characterization of 2D Mo_2C

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Chemistry Seminar on *2D Molybdenum Carbide*

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Abstract: Two-dimensional (2D) ultrathin carbides, such as molybdenum carbide (Mo_2C), possess exceptional properties that make them promising candidates for advanced technological applications. However, achieving large-area, high-quality crystals with uniform morphology remains a significant challenge.

Mo_2C can be synthesized via two primary approaches: a top-down method involving selective etching of MAX phases (e.g., Mo_2Ga_2C), which yields Mo_2C MXene, and a bottom-up approach using chemical vapor deposition (CVD), which results in orthorhombic Mo_2C. Both techniques offer distinct advantages and limitations. Following a comparative overview of these synthesis approaches, this seminar will delve into our investigations on the CVD growth of 2D Mo_2C.

While CVD is a powerful technique for Mo_2C synthesis, it presents challenges such as random crystal sizes and the unintended co-deposition of graphene. This talk will provide an in-depth analysis of the fundamental mechanisms governing 2D Mo_2C growth through CVD, highlighting key process parameters that influence material morphology and properties. Factors including temperature, growth duration, precursor flow rates, catalyst type and thickness, graphene formation will be examined to optimize synthesis conditions. Additionally, the underlying causes of process inconsistencies, such as furnace conditions will be also discussed in relation to reproducibility.

Furthermore, ongoing investigations into the properties of synthesized Mo_2C will be presented, covering chemical stability and initial assessments of its electrical characteristics. These findings offer valuable insights into the potential applications of Mo_2C, while ongoing research continues to refine our understanding of its functional behavior.

About the speaker: Dr. Buke is a full professor in materials science and engineering at TOBB ETU, specializing in the synthesis, characterization, and application of nanostructures (carbides, graphene, CNTs). Currently, she is on sabbatical at the A.J. Drexel Nanotechnology Institute.

Dr. Buke earned her B.S. and M.S. degrees from Middle East Technical University, completing her master's under Dr. Timucin, an alumnus of the University of Missouri-Rolla. She obtained her Ph.D. from Drexel University under Prof. Dr. Yury Gogotsi. During her doctoral studies at Drexel University, she was inspired by both the scientific and leadership qualities of Dr. Gogotsi, Dr. Guceri, and Dr. Choi, the department head (Mechanical Engineering) at the time, who later became the president of the University of Missouri System.

Returning to Turkey, Dr. Buke joined TOBB University, where she established the Nanomaterials Research Group and secured significant funding from organizations including the U.S. Air Force Office of Scientific Research (AFOSR).

In addition to her research, Dr. Buke has held several administrative roles at TOBB ETU, including vice chair of the department, vice director of the Graduate School of Engineering and Science, and, since 2020, vice provost for research and technology transfer.