Emerging Two-Dimensional Materials *via* Wet- chemistry: Application in Energy and Electronics

Ali Shaygan Nia and Xinliang Feng

Max Planck Institute for Microstructure Physics, Department of Synthetic Materials and Functional Devices, Halle, Germany
Chair for Molecular Functional Materials, Center for Advancing Electronics Dresden (cfaed) Technische Universität Dresden, Dresden, Germany

ali.shaygan_nia@mpi-halle.mpg.de

2D layered materials (2DLM), including van der Walls heterostructures (vdWHs), intercalated compounds, and superlattices, are important building blocks for the next generation of energy devices as well as (opto-)electronic, spintronic, and quantum devices due to their remarkable chemical and physical properties. To this end, scalable synthesis of 2DLM with high purity and specific functionalities is key to advancing fundamental studies toward applications. In this context, we use wet chemistry methods, in particular **electrochemical intercalation and exfoliation**, to synthesize 2DLM. Another key feature of wet chemistry is the **solution processability** of the developed 2DLM, which enables scalable device fabrication using different printing technologies such as inkjet and 3D printing.

Among different synthetic protocols, electrochemical exfoliation[1] of layered materials is a very promising approach that offers high yield, excellent efficiency, low cost, simple instrumentation, and excellent up-scalability. Remarkably, playing with electrochemical parameters enables functionalization and tunable material properties and increases the material diversities from graphene to a broad spectrum of 2D semiconductors[2], 2D magnets, etc.

"In this talk, I will take you through our journey, starting from the early stages of developing electrochemical exfoliation techniques for graphene and other 2D materials to their upscaling and diverse applications in electronics and energy storage. This journey ultimately led to the creation **two spin-off companies**: one focused on the "**production of 2D materials"** and the other dedicated to developing "**aqueous batteries,"** specifically zinc-based batteries.

References

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Figures

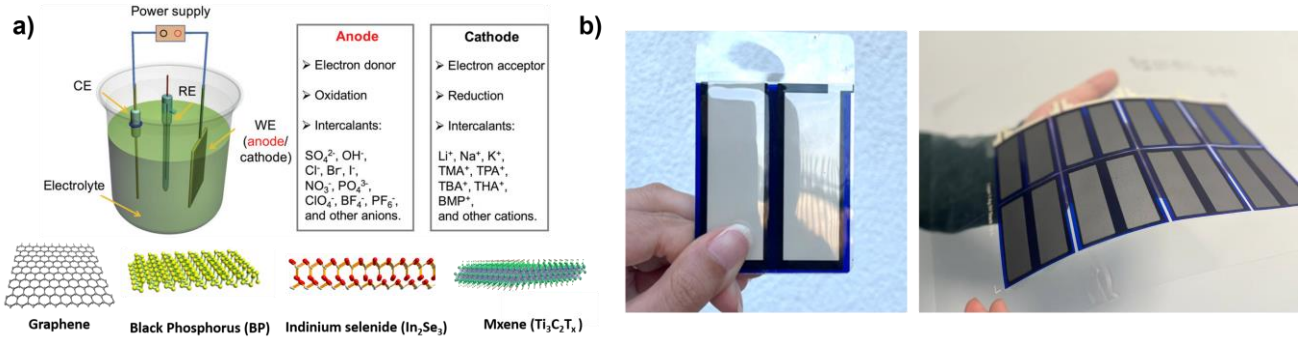

Figure 1: a) Electrochemical exfoliation process to produce 2D materials **b)** Graphene-based printed battery prototypes