Preparation of Emerging 2D Materials and their Heterostructures by Electrochemistry

Huanhuan Shi
Xinliang Feng, Dirk Fuchs, Matthieu Le Tacon
Karlsruher Institut für Technologie, Hermann-v.-Helmholtz-Platz 1
76344 Eggenstein-Leopoldshafen, Germany
Huanhuan.Shi@kit.edu

Abstract

2D materials and their heterostructures have attracted tremendous research interest Since their unique mechanical, electrical and optical properties hold great potential in novel applications for electronics and optoelectronics. High-yield production of 2D materials and their vdWHs with high quality is a key to fundamental studies and especially industrial applications. Electrochemical intercalation has been proved a very promising approach that can delaminate the layered materials with high yield. Here we will show preparation of high-quality emerging 2D materials and their vdWHs by using electrochemical intercalation. At the end, the emerging trends, challenges, and opportunities in electrochemical intercalation are also highlighted.

References

[1] **H. Shi**, M. Li, A. S. Nia, M. Wang, S. Park, Z. Zhang, M. R. Lohe, S. Yang, X. Feng, *Adv. Mater.* **2020**, 32, 1907244.
[2] **H. Shi**, M. Li, S. Fu, C. Neumann, X. Li, W. Niu, Y. Lee, M. Bonn, H.I. Wang, A. Turchanin, A. Shaygan Nia, S. Yang, X. Feng, *Angew. Chem. Int. Ed.*, **2023**, 62, e202303929.
[3] **H. Shi**, D Fuchs, M Le Tacon, **2024**, unpublished.

Figures

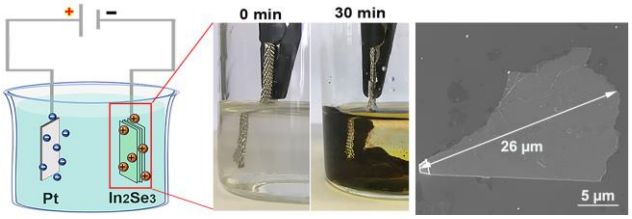

Figure 1: Ultrafast electrochemical synthesis of defect-free In_2Se_3 flakes.

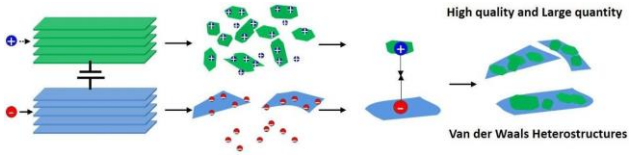

Figure 2: High-throughput synthesis of van der Waals heterostructures through electrochemistry.

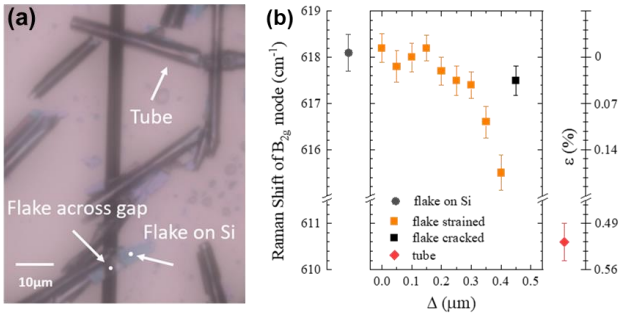

Figure 3. Strain induced Raman Shift of B_{1g} mode in $TbMnO_3$ membranes.