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Electrochemical intercalation of lithium ions into $NbSe_2$ nanosheets EMILY HITZ, JIAYU WAN, (UMD), ANAND PATEL, (NIST), YUE XU, (UMD), LOUISA MESHI, (NIST), JIAQI DAI, YANAN CHEN, (UMD), ALBERT DAVYDOV, Materials Science and Engineering Division, National Institute of Standards and Technology, Gaithersburg, Maryland 20878, USA, LIANGBING HU, Department of Materials Science and Engineering, University of Maryland, College Park, MD 20742, USA — Transition metal dichalcogenides (TMDCs) have been known for decades to have unique properties and recently attracted broad attention for their two-dimensional (2D) characteristics. One TMDC that has been studied for its charge density wave transition behavior and superconductivity is metallic $NbSe_2$, yet it is still largely unexplored for device applications in electronics, optics, and batteries. Through this work, we demonstrate successful electrochemical intercalation of lithium ions into layered $NbSe_2$. We present evidence of lithium intercalation as a technique capable of modifying the material properties of hexagonal $NbSe_2$ for further study. We confirm our result through X-ray diffraction, showing a unit cell size increase in $NbSe_2$ after intercalation from 12.57 Å to 13.57 Å in the "c" lattice dimension. Additionally, planar half-cell micro-battery devices are fabricated using ultra-thin $NbSe_2$ from platelets to observe Li-ion intercalation through an increase in the optical transmittance of the material in the visible range. At 550 nm wavelength light, we observed an increase in the optical transmittance of the material by 26% due to electrochemical intercalation.

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