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Thickness-dependent Dielectric Constant of Few-layer In_2Se_3 Nano-flakes DI WU, Department of Physics, University of Texas at Austin, ALEXANDER PAK, Department of Chemical Engineering, University of Texas at Austin, YINGNAN LIU, XIAOYU WU, YUAN REN, Department of Physics, University of Texas at Austin, YU-HAO TSAI, Department of Chemical Engineering, University of Texas at Austin, MIN LIN, HAILIN PENG, College of Chemistry and Molecular Engineering, Peking University, Beijing China, GYEONG HWANG, Department of Chemical Engineering, University of Texas at Austin, KEJI LAI, Department of Physics, University of Texas at Austin — The dielectric constant or relative permittivity of active materials in electronic devices is a critical parameter for charging and screening effects. For layered two-dimensional (2D) materials, it is of great interest to understand how their dielectric constants depend on dimensionalities and the arrangement of crystal lattices. Here we present both experimental and theoretical investigations on the dielectric constant of few-layer In_2Se_3 nano-flakes grown on mica substrates by van der Waals epitaxy. A nondestructive microwave impedance microscope (MIM) is employed to simultaneously quantify the number of layers and local electrical and optical properties. The measured effective dielectric constant increases monotonically as a function of the thickness and saturates to the bulk value at around 6-8 quintuple layers. The same trend of layer-dependent dielectric constant is also revealed through a density functional theory approach. Our results of the dielectric response are expected to be significant for the applications of layered materials in nano-devices.

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