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Small energy gap of CrBr3 revealed by Scanning Tunneling Microscopy and Spectroscopy (STM/S) DINESH BARAL, ZHUANGEN FU, ANDREI S. ZADOROZHNYI, RABINDRA DULAL, AARON WANG, NARENDRA SHRESTHA, UPPALAIAH ERUGU, JINKE TANG, YURI DAHNOVSKY, JIFA TIAN, TEYU CHIEN, University of Wyoming — $CrBr_3$ is a 2D magnetic van der Waals (vdW) material. Despite the great attention on the magnetic properties, the electronic properties of the $CrBr_3$ are relatively unexplored. The energy gap of $CrBr_3$ is believed to be in the range of 1.68-2.1 eV based on the optical measurements, while the DFT calculations in literature exhibited an even larger deviation of the energy gap values. Here, we present the measurements of the $CrBr_3$ flakes (both thin and thick) by using scanning tunneling microscopy and spectroscopy (STM/S). Along with the DFT calculations, a small energy (0.57 0.04eV) is revealed. The multiple peak $\mathrm{d}I/\mathrm{d}V$ spectra were measured on a defect free topography region. Excellent agreements between the reported optical transitions in literature and peak pair energy differences in our $\mathrm{d}I/\mathrm{d}V$ data further confirm that all the measured peaks are intrinsic to $CrBr_3$, and leads to the small energy gap determined by the two peaks closest to the Fermi energy. DFT calculation with U = 5 eV and J = 3 eV reproduces this energy gap. Last, edge degradation was observed on mono- and bi-layer flakes due to ˜15 minutes air exposure during sample transfer. These observations provide important information towards the fundamental understanding of $CrBr_3$.

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