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Current-Voltage Characteristics Along Terraces in MBE-Grown Bi_2Te_3 RITA MACEDO, University of California, Davis, SARA HARRISON, Stanford University, TATIANA DOROFEEVA, University of California, Davis, JAMES HARRIS, Stanford University, RICHARD KIEHL, University of California, Davis — Capturing the novel, but elusive, physics of topological insulators for electronic devices will require a baseline characterization of their surface electronic properties in an ambient environment. We report on the current-voltage (I-V) characteristics observed along terraces in MBE-grown Bi_2Te_3 by room-temperature conductive atomic force microscopy (C-AFM). The films were grown on sapphire by a two-step MBE process, leading to large-area films with micrometer-sized domains formed by wide concentric atomically flat terraces with a typical width of 170 nm and a step height of 1 nm. Control samples comprised of spherical nanoparticles and HOPG terraces were also examined for comparison. The Bi_2Te_3 C-AFM measurements consistently showed well-behaved, nearly symmetric exponential I-V characteristics with similar ideality factors on terraces and in the transition regions between terraces. Notably, current in the 25-nm transition regions was 10X higher than on the terraces. Negligible current increase was observed for the controls, indicating that this behavior is not an artifact of the tip-sample contact, but rather is due to a difference in the conductance along the Bi_2Te_3 terrace edges. Possible mechanisms including oxide, doping, defect, strain and topological effects will be discussed. These results motivate further edge conduction studies in these materials as essential background for studying topological insulator physics and devices.

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