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Electron-beam nanosculpting and materials analysis of exfoliated bismuth selenide SARAH FRIEDENSEN, WILLIAM PARKIN, JEROME MLACK, MARIJA DRNDIC, University of Pennsylvania — We report on nanosculpting Bi_2Se_3 with a highly-focused electron beam in a scanning transmission electron microscope (STEM). Exfoliated Bi_2Se_3 flakes were transferred onto silicon nitride TEM windows and structures at least 100 nm by 100 nm in size were selected for shaping. Focused ion beam (FIB) cutting was used to carve larger features into the structures and provide preliminary thinning if desired. Then, a STEM probe was used to sculpt more delicate features, including nanowires of approximately 20 nm in width, point contacts, and T-shaped junctions. During STEM cutting, the structures were monitored using energy dispersive X-ray spectroscopy (EDS) mapping, electron diffraction, and high-resolution imaging, and it was found that the crystal structure remains largely intact. This process opens the way for in-situ determination of the effects of size and structure on electrical and thermal properties of Bi_2Se_3 and fabrication of nanodevices with more elaborate geometries than can be achieved with growth methods alone.

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