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AFM, Raman and electrical transport studies of topological insulating materials subjected to argon plasma etching ISAAC CHILDRES, JIFA TIAN, IRENEUSZ MIOTKOWSKI, YONG CHEN, Purdue University — Plasma etching is an important tool in nano-device fabrication. We report a study on argon plasma etching of exfoliated flakes of topological insulator materials Bi_2Se_3, Bi_2Te_3, Sb_2Te_3 and Bi_2Te_2Se. We present data from atomic force microscopy (AFM), Raman spectroscopy and low-temperature magneto-transport measurements. The thickness of our samples measured by AFM is observed to decrease approximately linearly with plasma exposure time. We extract an etching rate for each type of material. For the initial increase in plasma exposure time, we observe increasing intensity and width of the characteristic ${E_g}^2$ Raman peak with little change in peak position. The width of this peak for etched flakes becomes larger than those of unetched samples of the same thickness. Additionally, we find that even moderate etching can significantly reduce the conductivity and hall mobility. These results indicate disorder is generated by plasma etching and impedes both phonon and carrier transport. Our findings are valuable for understanding the effects of argon plasma etching on topological insulator materials and using irradiation as a potential method to introduce controlled disorder in such materials.

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