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Molecular Etching of Pure and Mn Intercalated $TiSe_2$ using an STM TIM KIDD, BRETT GAMB, POLINA SKIRTACHENKO, LAURA STRAUSS, University of Northern Iowa — STM is normally a non-destructive technique. However, some materials, such as the transition metal dichalcogenides (TMDCs), are so weakly bonded that STM measurements performed in air can change the surface topology. We performed STM measurements on single crystals of $TiSe_2$ and $Mn_{0.05}TiSe_2$ in air. Under normal scanning conditions, the surface of both $TiSe_2$ and $Mn_{0.05}TiSe_2$ would spontaneously etch, removing single and double molecular layers. In pure $TiSe_2$, step edges were unusually rounded and the etching predominately occurred along the scanning direction. In $Mn_{0.05}TiSe_2$, the etching occurred even more readily. However, step edges in these samples were much straighter, reflecting the crystal symmetry. The symmetry was also seen in the etching of these samples, as triangular pits were often formed along with the usual etching along the scanning direction. The differences seen in the etching of $Mn_{0.05}TiSe_2$ samples indicate intercalated ions can affect both intra- and inter-layer bond strengths. The etched material disappeared completely from the sample, suggesting that TiSe2 molecules are energized sufficiently to sublimate from the sample. This research indicates that the etching process can be controlled to induce complex nanostructures in the surface of TMDCs.

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