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# Single-ion-induced surface modifications on H/Si(001) - significant difference between slow highly charged and swift heavy ions

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Electronic excitation caused by swift heavy ions (SHI) in solids often leads to permanent changes in the crystal structure, either by direct excitation or electron-phonon coupling following the initial electronic excitation. At single crystal surfaces, this leads to modifications of the topography which can be detected in real space by means of scanning probe techniques. For monoatomic projectiles, no such permanent surface restructuring has been reported for crystalline silicon up to a stopping power of 21 keV/nm so far. On the other hand, theoretical models suggest a lower threshold for atomic rearrangement in silicon.

In this study, we increased the sensitivity for ion-induced damage on a silicon surface by using hydrogen-terminated Si(001) surfaces in combination with scanning tunnelling microscopy (STM). Desorption of single hydrogen atoms or molecules leads to a clear signature in the STM images and thus damage could be resolved on the atomic scale. In comparison with slow highly-charged ions (HCI), swift heavy ions show, if at all, a very localized effect on the H/Si(001) surface.

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