Investigating the (001) Surface of K-rich Feldspar Minerals on the Atomic Scale

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Ice nucleation plays a fundamental role in the formation of mixed-phase and ice clouds and, thus, the understanding of ice nucleation is essential for the development of more reliable climate models. Most ice nucleation in the atmosphere is heterogeneous caused by ice nucleating particles such as mineral dusts or organic aerosols. In this regard, feldspar minerals have gained great interest recently as they are found to be one of the most important ice nuclei under mixed-phase cloud conditions. The mechanism by which feldspar minerals facilitate ice nucleation, however, remains elusive. Here, we present atomic force microscopies of K-rich feldspar (001) mineral surfaces cleaved and analyzed in ultrahigh vacuum. On the nanometer scale, we find that our feldspar samples exhibit a rich microstructure with a high density of step edges and other surface features. On the atomic scale, we observe several different contrasts, which can be grouped in two classes. The first class shows a regular array of spherical features, while the other consists of stick-like features. These insights into the surface structure at the nanometer and atomic scale will hopefully contribute to understanding the excellent ice nucleating ability of feldspar minerals.