

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2021-18

Anonymous Referee #2

Referee comment on "Effect of chemically induced fracturing on the ice nucleation activity of alkali feldspar" by Alexei A. Kiselev et al., Atmos. Chem. Phys. Discuss.,
<https://doi.org/10.5194/acp-2021-18-RC2>, 2021

General Comment

This manuscript focuses on identifying the potential role of (100) plane/close to (100) orientation in the exceptionally high ice nucleating ability of perthitic alkali feldspar. This has been achieved using a combination of carefully designed experimental procedure and laboratory-based techniques which complement each other. The authors make a great use of the knowledge/literature on feldspar mineralogy in deducing factors affecting the ice nucleating ability of the mineral class. While I fully support the publication, I do have few minor remarks that the authors should address while preparing the final version of the manuscript.

Minor comments:

Authors are encouraged to incorporate a sketch in either the Introduction or Sect 2.1.1 that shows/highlights the feature of Murchison plane in reference to a standard crystal lattice for an easy visual understanding. (Lines 58-61)

Did the authors observe any perceivable changes in the structure of the Na-rich, chemically induced crack regions after one or several freezing events? Given that the frozen fraction curves do not differ much over replicate measurements on a grain mount (e.g. FS08-64o), is it safe to assume that the morphology of such structures are quite stable? (in reference to Figure 3 & 4)

Line 146 It is not very clear why authors specifically chose to test the (010) plane (and not as powder suspension) of alkali feldspar from Pakistan (sample FS06-010). A short explanation can be added regarding this.

A brief yet critical discussion on the drastic difference between the ice nucleating ability of the chemically modified samples (grain mounts; FS08-64o/64c/01) and the original powder (FS08-VS) is missing. Does the latter have entirely different nature of ice active sites? Or do the authors suggest that the ice nucleating ability in powder form still originates from the perthitic structures, albeit further enhanced after chemical modification?

Line 52-53 Is that a common feature amongst all alkali feldspars or authors are referring to any specific type? Needs clarification

Lines 92-93 How did the authors determine whether the surface attained equilibrium with the solution? Did they monitor the change in composition over time? Needs clarification

Lines 93-94 As mentioned earlier, this compositional alteration happens only at the surface. Can the authors comment on the depth and fraction of surface area altered (either qualitative or quantitative), if possible?

Lines 115-116 Was the third batch of particles exposed to lab/surrounding conditions during this annealing process to room temperature? This should be clearly stated

Line 275-278 In reference to Kiselev et al. (2017), can the authors comment on the findings of Soni and Patey (2019) regarding (100) surface. A brief discussion on this would be useful as the current manuscript builds upon the previous findings

Line 300 "...at 850 °C." reference needed

Line 341 "...depend on composition,.. " composition of what?

Technical comments:

Line 25 ...Earth's...

Line 34 Can add abbreviation 'IN' here as 'ice nucleation' appears here the first time in the main text

Line 51 I assume the authors mean , as the notation of the planes (not (-101) and (20-1)). The notation needs to be corrected throughout the manuscript

Line 86an NaCl-KCl....

Figure 1: Tick marks missing on X-Y axes

Line 205 unusually large spacing at "...of S_{FS} .."

Figure 4: There are unidentified data sets in beige and violet color (underlying FS08-64c & 64o) in Panel A. Please check

Line 301 "...550°C locally reverses the..."

Line 335 "...that are developed..."

Line 375 "thermodynamically unstable" instead of "not thermodynamically stable"

Line 377 ".....giving rise to..."

Line 435 "overprint or" not needed

Line 451 delete period sign after "...4404-N"

References

Kiselev, A., Bachmann, F., Pedevilla, P., Cox, S. J., Michaelides, A., Gerthsen, D., and Leisner, T.: Active sites in heterogeneous ice nucleation—the example of K-rich feldspars, *Science*, 355, 367-371, 10.1126/science.aai8034, 2017.

Soni, A., and Patey, G. N.: Simulations of water structure and the possibility of ice nucleation on selected crystal planes of K-feldspar, *J. Chem. Phys.*, 150, 214501, 10.1063/1.5094645, 2019.