

# ***Interactive comment on “Review of experimental studies on secondary ice production” by Alexei Korolev and Thomas Leisner***

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This is an excellent review article of a process that is very important for precipitation development, Secondary Ice Production (SIP). Based on observations I've made and those reported on by others, the process is particularly important when 1) cloud top temperatures are relatively warm, 2) there are relative few but some ice nuclei active at the cloud temperatures, 3) the cloud droplet sizes are relatively large, and the updraft velocities, although present, and not too strong, one to a few meters per second. SIP is therefore likely to be most active and important over relatively warm oceanic areas. Although several SIP mechanisms have been proposed, it is unclear when specific ones are active and under what conditions they occur.

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This article discusses the plusses and minuses of the following SIP that have been proposed: (1) shattering during droplet freezing; (2) the rime splintering (Hallett-Mossop) process; (3) fragmentation due to ice-ice collision; (4) ice particle fragmentation due to thermal shock; (5) fragmentation of sublimating ice; and (6) activation of ice nucleating particles in transient supersaturation around freezing drops. The article focuses on laboratory studies, although some field observations are presented. Obviously, laboratory studies benefit from the ability to repeat experiments and narrow down possible processes by modifying the experiments appropriately.

I have relatively few comments because the article is very well written and extremely thorough.

Line 34: Schaefer

Line 59: "shattering" to "fragmentation"

Section 2.2, Eqs. (1) and (2), Freezing Fraction. Shouldn't ventilation enter into this discussion? It is factored into Eq. (3).

Section 2.7, Fragmentation during freezing. A table summarizing your discussion of shattering during drop/droplet freezing would be very helpful.

Line 445: During the freezing process, the surface of the droplet is sublimating, perhaps affecting the fragmentation process.

Line 649: undersaturated>subsaturated.

Line 732 "bigger" to "larger".

Line 783: the existence of shattering.

Line 824: concentration.

Line 825: You could mention the airborne studies of Mossop and Bigg and the use of balloon borne replicators, etc that can shed light on the problem. Many other airborne

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studies (Heymsfield and Willis, Lawson et al., Lasher-Trapp etc are directed towards the SIP problem. At the beginning of this section, re-emphasize that this review article is mostly directed towards laboratory and theoretical studies.

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