# SINTERING IN A DRY SNOW COVER

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ABSTRACT: Earlier theories of sintering in snow were based on an incorrect assumption about the geometry of the bond. The bond was assumed to have the reverse, or concave, curvature of liquid bridges between solids. However, since ice is a crystalline material, the neck must have a grain boundary groove which is the dominant feature of its geometry. The growth of necks between ice grains is modeled [Colbeck, J. Applied Physics, 1998] by the diffusion of water molecules out of the neck under a stress gradient. The grains are assumed to be spherical while the dihedral angle grows out to an equilibrium value of 145°. The growth is rapid at first so snow quickly develops some strength.

The growth rate is predicted to vary as the one-fourth power of time, a dependence which is a little stronger than observed. The time to sinter to a certain neck size is predicted to vary as the fourth power of the grain size, a dependence that is too strong according to the data of Kuroiwa but just right according to the data of Kingery. Better values of the diffusion coefficient for grain boundaries is needed to test the theory and other mechanisms may have to be added to accounted for the effects of a macroscopic temperature gradient and complicated grain shapes.

KEYWORDS: snow, snow crystal growth, snow metamorphism

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