

Crystal Data: Hexagonal or cubic (ice-VII). *Point Group:* $6/m\ 2/m\ 2/m$ or $2/m\ \bar{3}$. Crystals hexagonal, prismatic, to 0.5 m; as “snow” crystals, stellate, skeletal, flattened on [0001]; as “hail”, rounded and concentrically zoned; stalactitic, compact, massive; as “frost”, columnar, arborescent, feathery. *Twinning:* On {0001}; glides on {0001}.

Physical Properties: *Fracture:* Conchoidal. *Tenacity:* Brittle. Hardness = 1.5 D(meas.) = 0.9167 D(calc.) = [0.93] A liquid above 0 °C; diamagnetic.

Optical Properties: Transparent to translucent. *Color:* Colorless, white from inclusions, pale blue to pale green in thick layers. *Streak:* White. *Luster:* Vitreous.

Optical Class: Uniaxial (+). $\omega = 1.30907$ $\epsilon = 1.31052$

Cell Data: *Space Group:* $P6_3/mmc$. $a = 4.498$ $c = 7.338$ $Z = 4$ or $Pn\bar{3}m$ (ice-VII). $a = 3.163$

X-ray Powder Pattern: Synthetic.

3.90 (100), 3.66 (100), 2.25 (90), 3.4 (80), 2.07 (60), 1.92 (50), 2.67 (35)

X-ray Powder Pattern: Ice-VII.

2.237 (100), 1.291 (23), 1.582 (11), 0.845 (8), 1.118 (7), 1.000 (7), 0.913 (2)

Chemistry: H₂O of varying degrees of purity.

Polymorphism & Series: High pressure polymorphs include ice-VI and ice-VII.

Occurrence: Formed at low temperatures by sublimation in the atmosphere and in layers over open bodies of water; in glacial flows and thick masses of near-continental dimensions. Ice-VII as inclusions in diamonds indicates the presence of aqueous fluid in the mantle transition zone and in its boundary with the lower mantle.

Association: None.

Distribution: Worldwide; especially in polar icecaps and glaciers; as inclusions in diamonds.

Name: From Middle English *is*, *iis*, in turn from Old English *is*.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 495-498. (2) Bentley, W.A. and W.J. Humphreys (1931) Snow crystals. McGraw-Hill, New York, 227 p. (3) Nakaya, U. (1954) Snow crystals. Harvard Univ. Press, Cambridge, 510 p. (4) Bertie, J.E., L.D. Calvert, and E. Whalley (1963) Transformations of ice II, ice III, and ice IV at atmospheric pressure. *J. Chem. Phys.*, 38, 840-846. (5) Hall, D. and M.K. Wood (1985) A molecular-packing analysis of the crystal structures of ice. *Acta Cryst.*, 41, 169-172. (6) Tschauner, O., S. Huang, E. Greenberg, V.B. Prakapenka, C. Ma, G.R. Rossman, A.H. Shen, D. Zhang, M. Newville, A. Lanzirrotti, and K. Tait (2018) Ice-VII inclusions in diamonds: Evidence for aqueous fluid in Earth's deep mantle. *Science*, 359(6380), 1136-1139. (7) (2020) Amer. Mineral., 105, 1921 (abs. ref. 6).