## No. M19 $H_2O$, Ice

($M$ = 18.02; [D: 20.03])

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| 1a | Anomalous dielectric behavior of the hexagonal ice (Ih) and the cubic ice (Ic) for dc field was reported by Dengel et al. Possibility of ferroelectricity was mentioned for Ih and Ic by Dengel et al. and by Cubiotti and Geracitano, respectively. | 64Den<br>67Cub |
| b | At the atmospheric pressure, the hexagonal ice Ih (space group: $P6_3/mmc - D_{6h}^4$) is the stable phase. The cubic ice Ic (space group: $Fd3m - O_h^7$) is metastable. The ice Ic exists almost stably at low temperature, but irreversibly transforms to the hexagonal ice Ih above about 140 K. [a]) The ice Ic can be formed via the high pressure phase ice IX [b]) or in thin films deposited from the vapor below about –100 °C. [a])<br>A phase transition was observed at $\Theta$ = 72 K [D: $\Theta$ = 76 K] in ice Ih doped with KOH.[c]) [d]) [e]) The transition takes place at essentially the same temperature irrespective of the concentration of the dopants. The same transition was observed in ice Ih doped with other alkali hydroxides (LiOH [f]), NaOH [g]), RbOH [d])). The phase below $\Theta$ is called XI. | [a]) 70Fle<br>[b]) 87Yam<br>[c]) 82Taj<br>[d]) 84Taj<br>[e]) 86Mat<br>[f]) 88Miy<br>[g]) 87Mat |
| | Space group of ice XI for KOD-doped $D_2O$: $Cmc2_1 - C_{2v}^{12}$. | 85Lea |
| | Phase diagram: Fig. M19-001. | |
| 3a | Unit cell parameters in ice Ih: $a$ = 4.511(3) Å, $c$ = 7.346(3) Å at $T$ = 243 K.<br>See also Table M19-003, Table M19-004. | 90Got |
| b | Crystal structure: Table M19-001, Table M19-002, Table M19-003, Table M19-004; Fig. M19-002, Fig. M19-003, Fig. M19-004, Fig. M19-005, Fig. M19-006, Fig. M19-007. | |
| 4 | Temperature dependence of lattice constants: Fig. M19-008, Fig. M19-009, Fig. M19-010. | |
| 5a | Dielectric properties of pure ice: Fig. M19-011, Fig. M19-012, Fig. M19-013.<br>Dielectric properties of impurity doped ice: Fig. M19-014, Fig. M19-015, Fig. M19-016, Fig. M19-017, Fig. M19-018. | |
| 6a | Heat capacity of ice Ih and Ic: Fig. M19-019.<br>Heat capacity of impurity doped ice Ih: Fig. M19-020, Fig. M19-021, Fig. M19-022, Fig. M19-023, Fig. M19-024, Fig. M19-025, Fig. M19-026. | |
| b | Thermal conductivity: Fig. M19-027; see also | 80Sla,<br>94Ahm |
| 8a | Elastic constants by Brillouin scattering: see | 83Gam,<br>75Erm |
| | Acoustic velocity: see | 86Sha,<br>90Gag |
| | Attenuation of ultrasound wave: see | 86Tam |
| 9a | Optical constant: see | 84War |
| 10a | Central mode of Raman scattering: see | 82Bri |
| b | Effect of hydrostatic pressure on Brillouin frequency shift up to 30 GPa: see<br>See also 8a. | 83Pol |
| 11 | Electrical conductivity: see | 92Pet |
| | Surface conductivity: see | 83Car |
| | Thermally stimulated current: see | 67Cub,<br>95Jac |
| | Photoconductivity: see | 92Khu1 |
| | Photoluminescence of ice Ih: see | 92Khu2 |

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| 13a | NMR of protons of impurity doped ice Ih: see | 83Bar |
| b | ESR and ENDOR of X-irradiated ice Ih: see | 70Box |
| c | Mössbauer effect in ice Ic: see | 71Cam |
| 14a | Neutron time-of-flight spectra: Fig. M19-028; see also | 89Kuh |
| b | X-ray diffuse scattering in ice Ih: Fig. M19-029, Fig. M19-030. | |
| | Inelastic incoherent neutron scattering in ice Ih: see | 89LiJ, 91Klu |
| | Elastic diffuse neutron scattering in $D_2O$ ice: see | 80Sch |