

It is postulated that the film-like deposits form at 100 mmHg because of the high density of vapour in the narrow condensation region which comprises different supersaturation zones. This is confirmed by the fact that thin films composed of 2C-type pyrrhotite (FeS), marcasite and pyrite (FeS₂) were obtained near the evaporation source except for a few regions where the iron-rich sulphide was the single phase.

There are two restrictions on the conditions of film formation of the iron sulphide in this experiment: first, the only position at which the thin film could be obtained was at a distance of 7–15 mm from the evaporation source. Further away, the subsequent growth leads to the formation of iron sulphide smoke particles, until they aggregate into a chain of composition Fe_{1-x}S. Second, at lower pressures, 5 and 35 mmHg, the thin film obtained at the same position was not the cementite-type iron sulphide, but only 2C-type pyrrhotite used above as the standard sample. Further details will be published elsewhere.

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1 Powder Diffraction File, *ASTM No. 23-1112*, published by the Joint Committee on Powder Diffraction Standards.

2 Pedersen, B., and Grønsvold, F., *Acta Crystallogr.*, **12**, 1022 (1959).

Growth rates of freely falling ice crystals

THE only available set of laboratory measurements of mass growth rates of freely falling ice crystals, as a function of both time and temperature, used growth times < 50 s (ref. 1). We report here results of laboratory measurements on freely falling ice crystals (average mass, \bar{m}) grown in simulated cloud conditions, as a function of temperature for growth times of 60 ± 3 and 100 ± 5 s, and from these we have calculated the corresponding mass growth rates.

We wished to simulate the growth processes occurring in natural clouds, and therefore the measured ice crystals were produced in, and then grew while falling freely

Fig. 1 Average mass of freely falling ice crystals as a function of temperature for growth times of 1, 60 ± 3 s and 2, 100 ± 5 s.

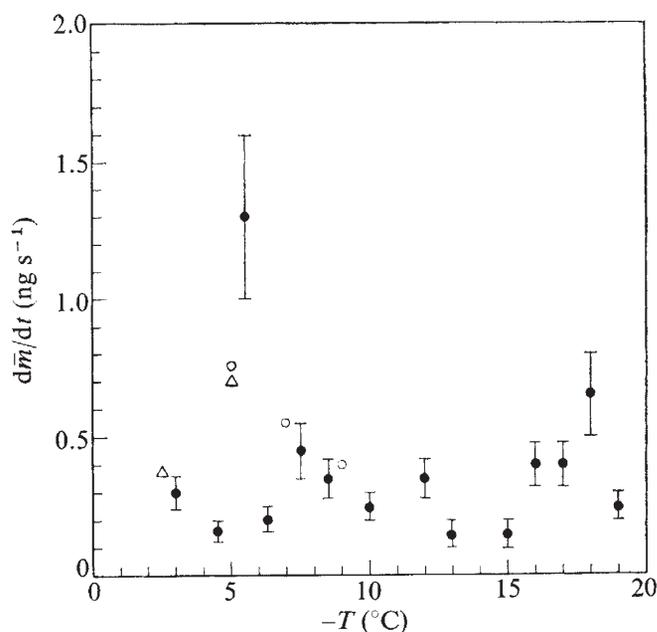
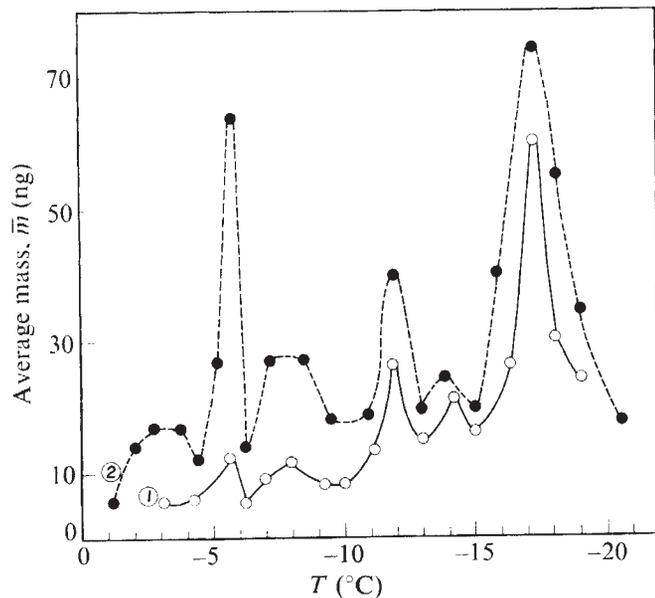


Fig. 2 Average mass growth rate of freely falling ice crystals as a function of temperature in the time range 60–100 s. calculated from: this work (●); Mason⁹ (△) and Ryan *et al.*¹⁰ (○)

through, fogs of supercooled water droplets with size spectra and concentrations similar to those of many rain clouds. The ratio of droplets to ice crystals was always > 8 : 1.

Ice growth was initiated by the rotation of a metal rod, cooled with liquid air, which locally seeded the supercooled fog with tiny ice crystals. The settling ice crystals were sampled by collecting them on a cooled glass slide coated by a layer of highly viscous silicone oil (DC 200/1,000). Each of the samples comprised ~ 150 crystals.

The average mass values of the samples were calculated from the measured diameters of the water droplets resulting from melting the collected ice crystals. Details of the experimental system and procedure are described elsewhere².

Figure 1 shows the temperature-dependent average mass of ice crystals, sampled at 60 ± 3 and 100 ± 5 s after seeding, and Fig. 2 shows their calculated temperature-dependent average mass growth rate in the time range 60–100 s.

It is obvious from Fig. 2 that, first, there are peaks in the growth rate at ~ -5.5 and -18 °C, as have been found previously^{1,3,4}; second, the maximum at about -5.5 °C is similar to the behaviour of the basal linear growth rate⁵, basal mean migration distance⁶ and basal step propagation velocity^{7,8}; and third, the few growth rates for the range 60–100 s, calculated from experiments by Mason⁹ and Ryan *et al.*¹⁰ are in good agreement with our results.

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- 1 Fukuta, N., *J. Atmos. Sci.*, **26**, 522–531 (1969).
- 2 Michaeli, G., thesis, The Hebrew University of Jerusalem (1975).
- 3 Hallett, J., *J. Atmos. Sci.*, **22**, 64–69 (1965).
- 4 Jayaweera, K. O. L. F., *J. Atmos. Sci.*, **28**, 728–736 (1971).
- 5 Lamb, D., and Scott, W. D., *Cryst. Growth*, **12**, 21–31 (1972).
- 6 Mason, B. J., Bryant, G. W., and Van Den Hauvel, A. P., *Phil. Mag.*, **8**, 505–526 (1963).
- 7 Hallett, J., *Phil. Mag.*, **6**, 1073–1087 (1961).
- 8 Kobayashi, T., *Proc. Conf. Low Temp. Sci.*, 1966 (edit. by Oura, H., **1**, 95–104 (The Institute of Low Temperature Science, Hokkaido University, Japan, 1967).
- 9 Mason, B. J., *Q. Jl R. Met. Soc.*, **79**, 104–111 (1953).
- 10 Ryan, B. F., Wishart, E. R., and Holroyd, E. W., *J. Atmos. Sci.*, **31**, 2136–2141 (1974).