COMMENTS

Comments are short papers which criticize or correct papers of other authors previously published in the **Physical Review**. *Each Comment should state clearly to which paper it refers and must be accompanied by a brief abstract. The same publication schedule as for regular articles is followed, and page proofs are sent to authors.*

Comment on "Surface-tension-anisotropy measurements of succinonitrile and pivalic acid: Comparison with microscopic solvability theory"

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The purpose of this Comment is to clarify some inconsistencies in the paper by Muschol, Liu, and Cummins [Phys. Rev. A **46**, 1038 (1992)] regarding the data which we reported for ice [Koo, Ananth, and Gill, Phys. Rev. A **44**, 3782 (1991)].

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In their Tables I and II, which include ice, Muschol, Liu, and Cummins [1] compared for various materials the measurements of the selection parameter σ^*_{expt} and the degree of anisotropy in surface tension, ε_m. Ice dendrites [unlike succinonitrile (SCN), pivalic acid (PVA), and NH_4Cl], have vastly different values of ε_m and tip radii in the basal and edge planes. This is shown here for ice in our Fig. 1 by the photographs of an equilibrium droplet. The basal plane has sixfold anisotropy, $\varepsilon_6=0.1-0.3\%$, while the edge plane has two-fold anisotropy, $\varepsilon_2=30\%$, in surface tension.

The radius of curvature of the tip of the basal plane (R_2) of dendrites of ice is about 28 times larger in than that in the edge plane (R_1); while the SCN for example, $R_1 \simeq R_2$. Furthermore, the value of $\sigma^*_{\text{expt}} \approx 0.075$ shown in Table I and in Fig. 13 of [1] is not comparable to the other values of σ^*_{expt} in this table because it is based on the geometric mean of R_1 and R_2. For ice dendrites, Figs. 11–15 of Koo, Ananth, and Gill [2] showed how Stokes flow theory, together with $\sigma^*=0.075$, based on $R_m=2R_1R_2/(R_1+R_2)$, enables one to correlate accurately the intensity of natural convection, as reflected by the Grashof number Gr, based on R_m, as well as the growth velocity and tip radii (V_G, R_1, R_2), as functions of the undercooling ΔT. Therefore, since a selection theory is not available, R_m was chosen for correlating the σ^* data for ice dendrites.

Individual σ^* were found to be $\sigma^*_1=2\sigma d_0/V_G R_1^2=0.29$ and $\sigma^*_2=2\sigma d_0/V_G R_2^2=3.56\times10^{-4}$, in which the errors in the growth velocity V_G and tip radii R_1, R_2 are within $\pm5\%$ and $\pm10\%$, respectively. The physical properties used were taken from Hardy [3]. Thus σ^*_{expt} for the basal plane alone is about two orders of magnitude smaller than SCN and PVA. Hectaoctyloxytriphenylene also has sixfold anisotropy of 0.3%, which is about equal to ε_6 for the basal plane of ice. It also is im-

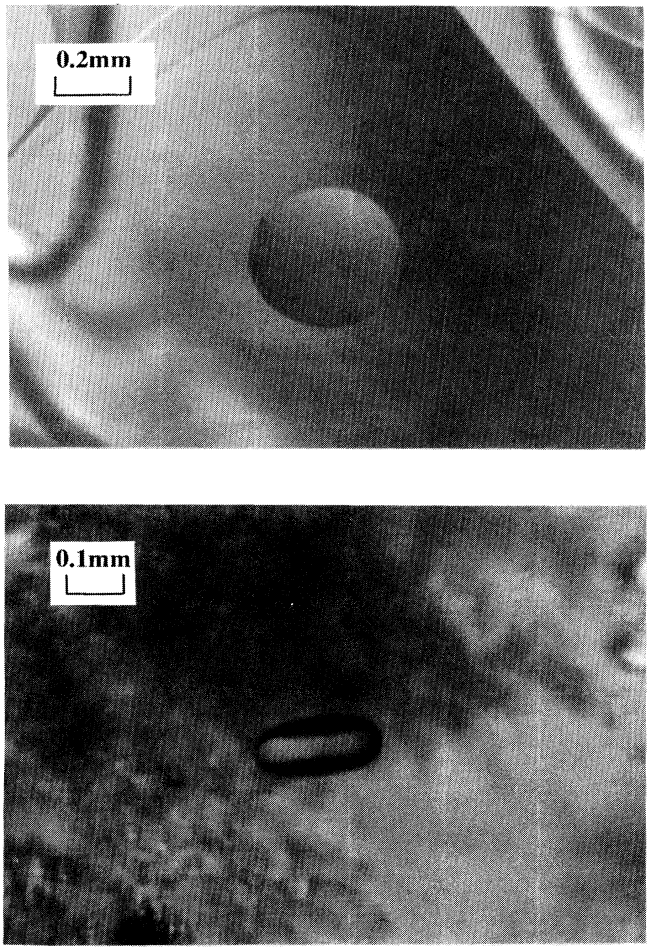

FIG. 1. Photographs of the equilibrium shape of water in the ice matrix: (a) basal plane, (b) edge plane.

portant to note that the value of $\sigma^*_{expt}=0.025$ reported in Table II for ice from Refs. 2 and 31 of Muschol, Liu, and Cummins [1] was not actually measured experimentally. It is a theoretical value which was used to correlate Fujioka's growth rate data for ice (Ref. [31], cited in Ref. [1]).

If one applies microscopic solvability theory to the basal plane of ice alone, one obtains $\sigma^*_{theor}=(4.4-8)\times 10^{-3}$ from the two-dimensional curve in Fig. 1. of [1] (with $\mu=4$), which is too high by an order of magnitude or more than our experimental value for the basal plane.

[1] M. Muschol, D. Liu, and H. Z. Cummins, Phys. Rev. A **46**, 1038 (1992).
[2] K. K. Koo, R. Ananth, and W. N. Gill, Am. Inst. Chem. Eng. J. **38**, 945 (1992).
[3] S. C. Hardy, Philos. Mag. **35**, 471 (1977).

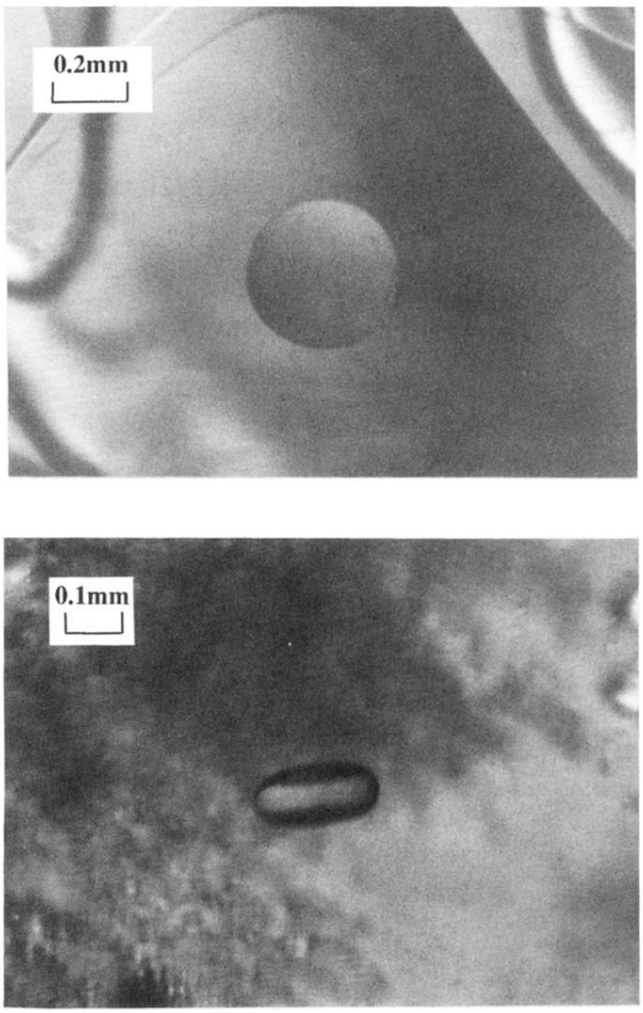

FIG. 1. Photographs of the equilibrium shape of water in the ice matrix: (a) basal plane, (b) edge plane.