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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Scanning electron microscopy and molecular dynamics of surfaces of growing and ablating hexagonal ice crystals" *by* W. C. Pfalzgraff et al.

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We are indebted to the reviewer for suggesting we revisit the question of the prismatic pyramidal – prismatic facet angle. The reason for quoting an approximate value ($\theta\sim14°$) was that too few measurements were made. This in turn followed because we selected for analysis only crystals having a small shoulder-to-face ratio, mostly q/p<0.05 (see Fig. 1 for a definition of q and p).

We subsequently went back to the SEM to collect more images, increased the q/p criterion to $\sim$0.2, and extrapolated values to q/p=0, as shown in Fig. 1. As the figure shows (and to our surprise), the $\theta\sim14°$ facet is very much in the minority. More com-

mon is the well-known, 28° (101bar1) facet. We are in the process of making more measurements of this type, with the aim of characterizing confidence intervals.

If more measurements support the presence of a statistically significant, $\theta\sim14°$ facet, we believe it would correspond to Miller-Bravais indices (202bar1). This facet has not, to our knowledge, been reported in connection with vapor-deposited ice growth, but it has been observed in ice crystals grown in aqueous antifreeze solutions derived from fish (Knight et al, 1991; Houston et al, 1998).

We have devised a speculative, two-step model for the role of growth strands in facilitating growth of the prismatic facet. In the model, a series of (101bar1) facets forms on a pristine prismatic surface, collectively forming the pattern we have identified as trans-prismatic strands (Fig. 2). In the second step, troughs collect vapor-deposited ice, forming a new prismatic surface. We hope to explore this hypothesis in future SEM work; in particular, ridge and trough angles of 180-2×28=124 degrees may be resolvable using stereoscopic imaging. Would it be useful to add a description of this model to the paper?

Houston, Jr., M. E., Chao, H., Hodges, R. S., Sykes, B. D., Kay, C. M., Sonnichsen, F. D., Loewen, M. C., and Davies, P. L.: Binding of an Oligopeptide to a Specific Plane of Ice, J. Biol. Chem., 273, 11714–11718, 1998.

Knight, C. A„ Cheng, C. C. & DeVries, A. L.: Adsorption of a-helical antifreeze peptides on specific ice crystal surface planes, Biophys. J., 59, 409-418, 1991.

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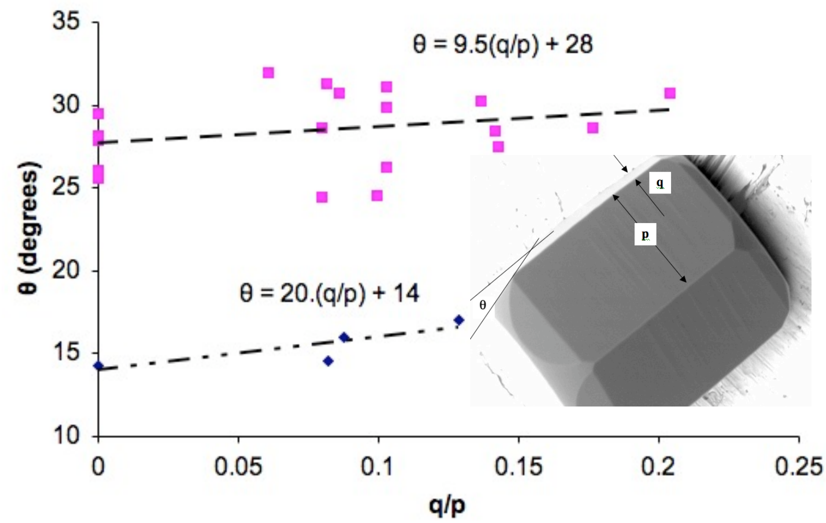
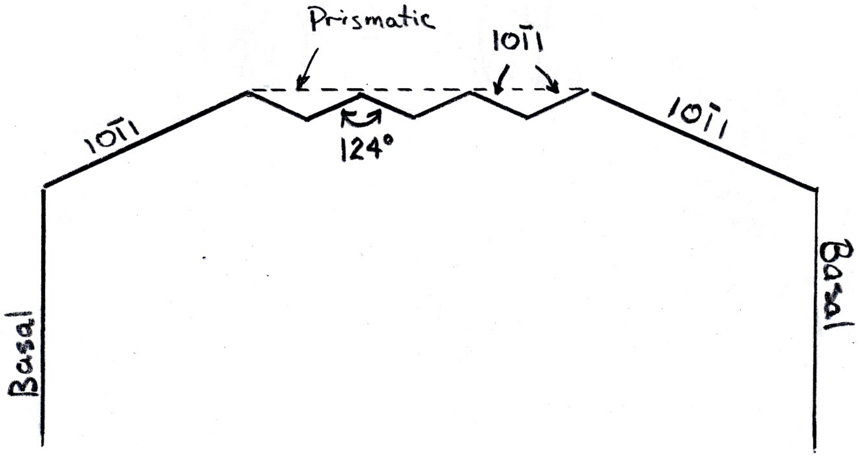


θ = 9.5(q/p) + 28
θ = 20.(q/p) + 14
θ (degrees)
q/p
q
p
θ

Fig. 1.



Prismatic
10$\bar{1}$1
10$\bar{1}$1
10$\bar{1}$1
124°
Basal
Basal

Fig. 2.