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FISH GLYCOPEPTIDE AND PEPTIDE ANTIFREEZES: THEIR INTERACTION WITH ICE AND WATER

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Abstract:

Glycopeptide and peptide antifreeze agents are present in the body fluids of polar fishes and allow them to avoid freezing in ice-laden seawater. These antifreezes lower the freezing point 200 times more than predicted by colligative relations, but have little effect on the melting point of ice. They bind to ice and appear to inhibit growth by increasing the curvature of growth steps on the ice crystal surface. Such a growth would result in a substantial increase in the roughness of the surface of the crystal. Laser light scattering techniques have been used to evaluate the dependence on temperature of the surface roughness at the ice/antifreeze solution interface.

Results show a dramatic increase in scattered light as the temperature is decreased toward the freezing point of antifreeze solutions.

COMMENTS

Remark of J.W. GLEN:

We have also begun some work on the effect of these materials on the physical properties of ice. D. Ives and I have made compression creep tests on randomly oriented polycrystalline ice in which, for the doped specimens, antifreeze glycoproteins supplied by D. Devries were included in the water introduced in making the specimens from frost particles. We are still at an early stage, but in all cases the creep rate of the doped ice is less than that of pure ice and no acceleration of the creep has yet been seen on our doped samples whereas pure samples showed acceleration. I should emphasize that these are very preliminary results based on the first four doped specimens. These results are of interest in connection with the report by Knight and Devries* that antifreeze glycoproteins prevent grain-boundary migration in ice and hence may well prevent dynamic recrystallization.