Measuring differential ion exclusion during the freezing of aqueous solutions.

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Workman−Reynolds freezing potentials have been measured for the first time across the interface between single crystals of ice 1H and dilute electrolyte solutions. The measured electric potential is a strictly nonequilibrium phenomenon and a function of the concentration of salt, freezing rate, orientation of the ice crystal, and time. When all these factors are controlled, the voltage is reproducible to the extent expected with ice growth experiments. Zero voltage is obtained with no growth or melting. For rapidly grown ice 1H basal plane into a solution of 10^{-4} M NaCl the maximum voltage exceeds 30 V and decreases to zero at both high and low salt concentrations. The effect does not occur when clathrate hydrate crystals of THF are grown into a salt solution.

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