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Interfacial Water Structure from Freshwater to Saltwater Brines

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Water at solid-liquid interfaces commonly differs from the bulk phase by adopting a polar, ordered structure. Electrolytes can act to perturb this structure, and as such, interfacial water in freshwater environments is not only different from its bulk counterpart, but also from counterparts in brackish, seawater, and sea-ice brine environments. In this study, sum-frequency generation spectroscopy, a surface-sensitive technique, is used to monitor electrolyte-induced changes of interfacial water structure. Solution ionic strength was varied over five orders of magnitude and spectra were collected from two mineral surfaces (fused silica and calcium fluoride) and two polymer surfaces (polystyrene and poly(methyl methacrylate)). Analysis of the spectra reveals both striking similarities and differences between these four aqueous interfaces. Spectral response at each of the four interfaces to salt addition is examined in the context of a model of charged interface nonlinear susceptibilities. From this analysis, inferences of interfacial structure and behavior are made.