Sum Frequency Generation of Water on NaCl, $NaNO_3$, $KHSO_4$, HCl, HNO_3, and H_2SO_4 Aqueous Solutions

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The vapor-liquid interface of aqueous inorganic acid and salt solutions are examined using Sum Frequency Generation (SFG). The results show that the SFG intensity of hydrogen-bonded water in 0.01*x*, where *x* = mole fraction, acid (HCl, HNO_3, and H_2SO_4) solutions is greatly enhanced compared to 0.01*x* of the corresponding salts (NaCl, $NaNO_3$, $KHSO_4$). This suggests that either surface water molecules in the acid solutions orient with the dipole more vertically aligned than those in the salt solutions or that more layers of water are ordered. These results are interpreted with an electric double layer model in which the double layer is comprised of subsurface anions and cations. The weak association of protons, as opposed to Na^+ or K^+, with anions results in a greater electric field at the surface in acid solutions. The decrease of non-hydrogen-bonded OH groups at the surface of acid and salt solutions indicates that the top layer of interfacial water molecules are most perturbed in those acid and salt solutions that contain larger anions.