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Correlation between Pyroelectricity and Alignment of Interfacial Water. DAVID EHRE, ELENA MEIRZADEH, ALIK BELITZKY , ERAN MISHUK, MEIR LAHAV, IGOR LUBOMIRSKY, Weizmann Institute of Science — In this work we investigate the connection between arrangement of water and pyroelectricity. Before the current work, pyroelectricity was attributed only to polar materials. Nevertheless, nonpolar Amino acid crystals and Yttrium doped Barium Zirconate ceramics exhibit pyroelectricity. Experimental results with MD simulation suggest that the source of pyroelectricity is polar arrangement of water molecules at the crystal surface, which leads to the formation of a deformed polar layer in the crystal. This makes the surface pyroelectricity an important surface characterization tool. Another phenomenon suggests that the converse effect to surface pyroelectricity is also exists i.e. alignment of water by pyroelectricity. We demonstrated that polar crystals in general and specifically positive pyroelectric charge can catalyze the freezing of supercooled water (SCW). Our studies show that pyroelectric effect increases the freezing point of SCW by 2 to 8 degrees. The fact that the freezing point is correlated to the amount of the surface charge together with the relative low electric field, implying that the surface charge aligns the interfacial water molecules or stabilizes sub-critical ice nuclei.

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