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Calorimetric studies on doped high-density amorphous ices

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Studies on doped crystalline ice phases have been done over the past decades. Dopants have allowed unlocking the kinetically hindered, but thermodynamically favored transitions to hydrogen ordered ices, allowing the discovery of ices XI[1], XIII[2], XIV[2] and XV[3]. The role of these dopants is to enhance the microscopic dynamics up to 100.000[4], as reveal by the dielectric studies. This enhancement is the key to induce hydrogen-ordering transitions at T < 150K. Given the claim of a high similarity between amorphous ices and crystalline ices (e.g., high-density amorphous ice and ice VI[5] or ice VII[6]), it is of interest to study which impact these dopants might have on hydrogen-ordering in amorphous ice. In the present contribution we discuss the influence of dopants on equilibrated high-density amorphous ice (e-HDA) by differential scanning calorimetry and compare the phenomenology (i.e., appearance of latent heat associated with hydrogen ordering, impact on glass transition step) with those cases usually reported for crystalline ices. None of the large variety of studied dopants has an influence like that seen earlier on crystalline ice, thereby refuting the claim of crystalline-like nature of e-HDA.

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Significance statement

The influence of dopants on amorphous ice was not studied in the past. Given the claim of high similarity between amorphous ices and crystalline ices, we present a detailed calorimetric study of how these dopants might influence amorphous systems. Concluding that no enhancement of hydrogen-ordered transitions can be observed.

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Track Classification: Amorphous Ice