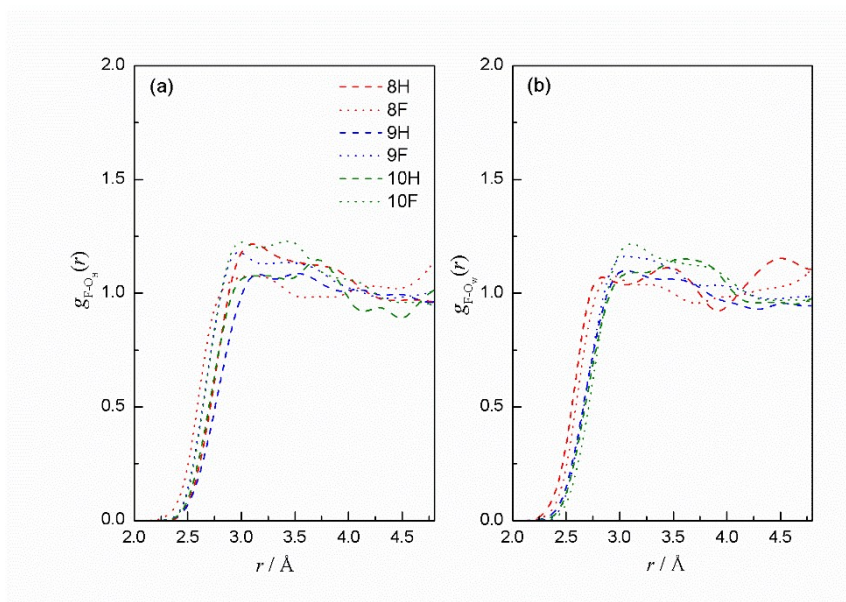
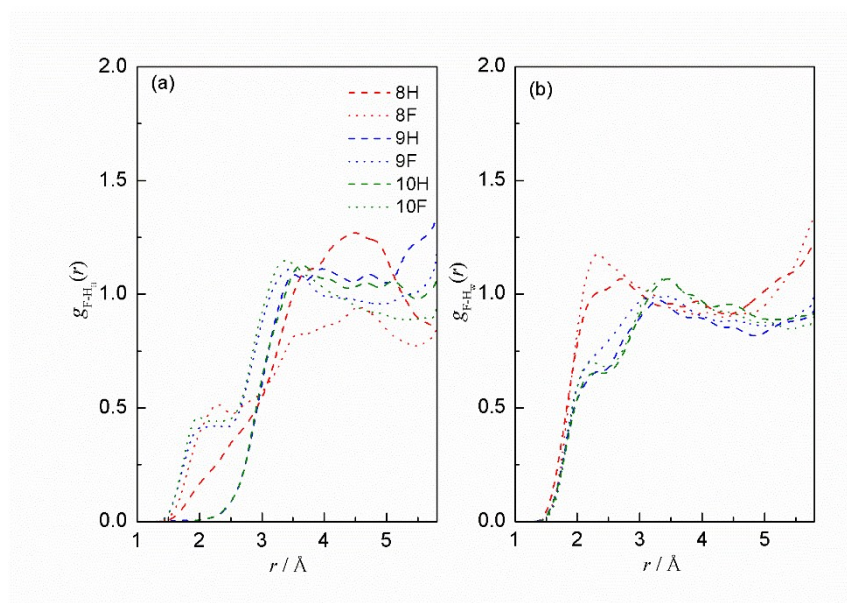


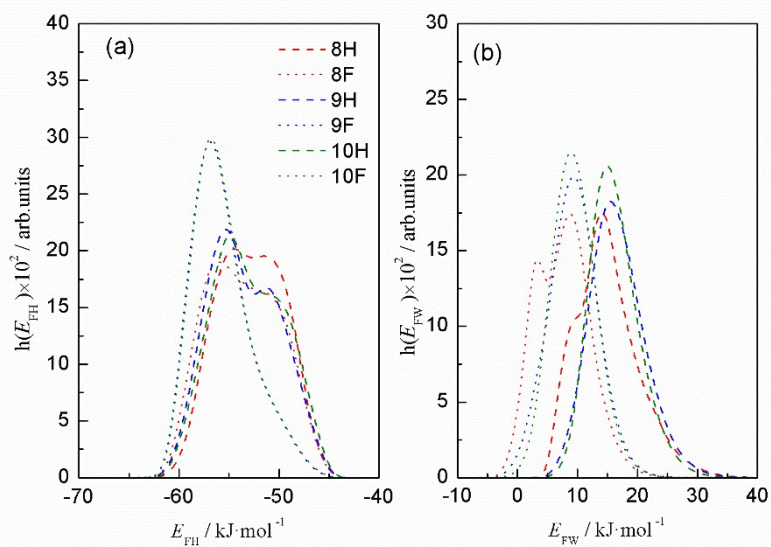
## Supplementary information



**Fig. S1** Radial distribution functions for the F-O pairs confined in the different CNTs: (a) F-O<sub>H<sub>2</sub>O</sub>, (b) F-O<sub>H<sub>2</sub></sub>. The capital letter F represents fluorine, O corresponds to oxygen and the subscripts W and H represent water and hydronium.



**Fig. S2** Radial distribution functions for the F-H pairs confined in the different CNTs: (a) F-H<sub>2</sub>O, (b) F-H<sub>2</sub>. The capital H corresponds to hydrogen.



**Fig. S3** Normalized statistical distributions of the pair-potential energy  $E_{ij}$  for the fluorine-hydronium (a) and fluorine-water (b) pairs that classified as hydrogen bonded by the geometric criterion.  $h(E_{ij})$  denotes the probability of molecular pairs of pair-potential energy  $E_{ij}$ .