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Chemical transformation of iodate(IO_3-) and nitrite(NO_2-) in frozen solution and its environmental implications.

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Ice is ubiquitous on earth and involved in various chemical reactions in the environment. Most chemical reactions are slowed down when temperature decreases according to Arrhenius equation. However, several chemical processes can be enhanced in frozen state. Reactive halogen species play important roles in the global environment. In particular, the presence of gaseous halogens in the polar and marine boundary layers is of great interest because these highly reactive species can affect ozone and mercury depletion events, oxidizing capacity, and DMS(dimethylsulfide) oxidation to form cloud-condensation nuclei. Among halogen compounds, the sources and emission mechanisms of inorganic iodine species in the polar region remain unclear. Iodide(I-) and iodate(IO_3-) are the most dominant iodine species in nature and their chemical transformation or I-/IO_3- ratio in frozen state remains poorly understood. Recent study shows that the production of active iodine compounds from frozen iodate salts during photochemical reaction. In previous study, nitrite(NO_2-) oxidation to nitrate(NO_3-), which is very slow reaction in aqueous solution, was significantly (105 times) accelerated in frozen state. The enhanced proton and oxygen concentration within ice grain boundaries are suspected that the enhanced oxidation of nitrite by freezing. Here we investigate chemical transformation of iodate/nitrite mixture in ice. The results show that the chemical reaction between iodate and nitrite in ice can potentially provide a new pathway for the source of reactive iodine species to the polar atmosphere. The detailed experimental conditions and mechanism will be discussed in the presentation.