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The first steps of iodine gas-to-particle conversion as seen in the lab: constraints on the role of iodine oxides and oxyacids

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The photooxidation of gas phase iodine-bearing molecules emitted by marine biota leads to intense particle nucleation events in the coastal and polar marine boundary layer[1-3]. The ubiquity of iodine in the marine atmospheric environment[4-7] has suggested that this may be a previously unrecognized global source of new aerosol particles[8]. Atmospheric modeling is required in order to evaluate the importance of this process, but a substantial lack of understanding of the gas-to-particle conversion mechanism is hindering this effort, especially regarding the gas phase chemistry of the nucleating molecules (iodine oxides[9,10] and/or oxyacids[7]) and the formation kinetics of molecular clusters. To address this problem, we have conducted new flow tube laboratory experiments where pulsed laser photolysis or continuous broad-band photolysis of I_2/O_3 mixtures in air are used to generate iodine radicals in the presence of atmospherically representative mixing ratios of water vapor. The molecular reactants and the resulting molecular products are detected by time-resolved VUV laser photo-ionization time-of-flight mass spectrometry. High-level quantum chemistry and master equation calculations and gas kinetics modelling are used to analyse the experimental data. In this presentation we discuss our results and their implications for the interpretation of field meassurements and for the implementatiion of an iodine oxide particle formation mechanism in atmospheric models.

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