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Kinetics and isomeric/isobaric product analysis of radical reactions in flow tube investigated by VUV photoionization mass spectrometry

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Photoionization mass spectrometry (PIMS) as a powerful method has been widely utilized and provided valuable insight in the field of gas-phase reactions. We present here a vacuum ultraviolet (VUV) photoionization orthogonal time-of-flight mass spectrometer (TOFMS) coupled with a microwave discharge generator and a fast flow tube reactor to study radical reactions of atmospheric and combustion interests. The tunable VUV synchrotron radiation at Hefei, China, and a commercial krypton discharge lamp were employed as photoionization light sources and the performances of the experimental setup, like the mass resolution ($M/M \sim 2000$) and the limit of detection (LOD ~ 1 ppb), are described. As representative examples, the self-reaction of the methyl radical, CH_3 , and the reaction of the methyl radical with molecular oxygen were studied and multiple species including radicals and isomeric/isobaric products were detected and identified in the photoionization mass spectra and the photoionization efficiency spectra (PIES) by scanning synchrotron photon energy. In addition, some preliminary results related to the kinetics of the reactions are presented.

Summary

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