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Separation of binary gas mixtures flowing through sampling orifices RAINER JOHNSEN, University of Pittsburgh, BARUN CHATTERJEE, Bose Institute, Calcutta — Sampling of ions from a reaction vessel through a small orifice into a differentially pumped ion mass spectrometer is a standard plasma-diagnostic method. In this context one faces the question if and to what extent the composition of a gas mixture, e.g. a carrier gas with an admixture of a reagent, is altered by the outflow of gases through the orifice, which is often in the transition regime between molecular and viscous flow. Our experience has shown that gas separation must be taken into account in drift tube measurements of ion-molecule reaction. However, the effect is poorly understood, somewhat counter-intuitive, and no rigorous theoretical treatment is available. We report here a series of drift-tube measurements, in which we used ion-molecule reactions to determine actual reagent concentrations as a function of carrier gas flow. We show that a simple semi-empirical model, in which the coupling of gas flows is modeled using the Langevin equation, reproduces observations reasonably well. The formula can be expressed in terms of easily available parameters and thus may be useful to investigators who need to assess gas separation effects in their applications.

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