HYDROGEN ABSTRACTION FROM METHANE BY BROMINE AND CHLORINE RADICALS: A DYNAMICS COMPARISON

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The abstraction of H or D from methane and its isotopologues by H, F, or Cl radicals has long been the poster child for gas phase bimolecular reaction dynamics experiments. Recently, our group has successfully carried out a reaction dynamics study of the hydrogen abstraction from CH_4 by Br radicals to produce CH_3 and HBr. To our knowledge, this is the first successful attempt at adding bromine to the repertoire of H abstraction collision partners in a molecular beam study. As a point of comparison for our Br experiments, we have also revisited the well understood H-abstraction from CH_4 by Cl. In the Br system, we see dramatic vibrational mode selectivity similar to that observed in previous studies done on the Cl analog system. However, due to the large barrier height of the H-abstraction by Br (4500 cm^{-1}) compared to that of abstraction by Cl (1200 cm^{-1}), the manifestations of the mode selectivity are markedly different in the two systems.