COLLISIONAL QUENCHING OF OH $A^2\Sigma^+$: PRODUCT DISTRIBUTION OF OH $X^2\Pi$

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Collisional quenching of electronically excited OH $A^2\Sigma^+$ radicals by molecular hydrogen is known to be an efficient process. Quenching of OH can proceed through a reactive channel, producing water and atomic hydrogen, or through a nonreactive channel, resulting in vibrationally and/or rotationally excited OH and H_2 products. This study examines the product state distribution of OH $X^2\Pi$ produced via the nonreactive channel. In this work, a UV laser prepares the OH $A^2\Sigma^+$ $(v' = 0, N' = 0)$ level in the collisional region of a pulsed supersonic expansion. After a short delay, a second UV laser probes the OH $X^2\Pi\,(v'', N'')$ produced from collisional quenching by exciting various rovibrational lines of the OH $A - X$ band. The product states are detected by collecting the OH laser induced fluorescence (LIF) signal. The fluorescence intensities are converted to relative populations by taking into account the fluorescence quantum yields, integration gates, fluorescence lifetimes and emission wavelengths of the OH $A^2\Sigma^+$: upper state.

The product state distribution of OH is highly non-statistical, with an inverted rotational distribution, demonstrating preferential pathways in the non-reactive quenching process. Experiments were conducted to investigate the full product state distribution including fine structure effects. The $\Pi(A')$ is preferred over the $\Pi(A'')$ lambda-doublet state. In addition, the F1 $X^2\Pi_{3/2}$ spin-orbit manifold is preferred at each rotational level. The non-statistical nature of the population distribution for each vibrational, rotational, spin-orbit and lambda-doublet state implies favored pathways for non-reactive quenching of OH $A^2\Sigma^+$ with H_2.