COLLISIONAL QUENCHING OF OH $A^2\Sigma^+$ BY H_2: LIFETIMES AND METHODS FOR PROBING THE NONREACTIVE PRODUCT CHANNEL

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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 can proceed through a reactive channel, producing water and atomic hydrogen, or through a nonreactive channel. The goal of this work is to study the outcome of the nonreactive quenching channel, and thereby extract information about the dynamical pathways that lead to quenching. A pump-probe scheme is utilized to determine the OH $X^2\Pi$ population distribution following collisional quenching in a pulsed supersonic expansion. The pump laser excites OH $A^2\Sigma^+$ $(v' = 0, N' = 0)$, resulting in a significantly reduced lifetime due to quenching. The probe laser monitors the OH $X^2\Pi$ (v'', J'') population via laser-induced fluorescence (LIF) on various $A - X$ transitions. To convert observed LIF intensities to a population distribution, it is necessary to account for the fluorescence quantum yield and lifetime of the emitting state. Quenching lifetimes for OH $A^2\Sigma^+$ radicals are measured at a temperature of ∼50 K and fit to a single exponential decay. Lifetimes of OH $A^2\Sigma^+$ $(v' = 0, N')$ show a dramatic increase with rotational level N', corresponding to a decrease in quenching efficiency. The experimental lifetimes are used to extract pseudo first-order rate constants for quenching as a function of N' under these conditions.