LIF MEASUREMENTS OF OH IN NEAR THRESHOLD $O(^3P)$ REACTIONS WITH CH_4 AND SiH_4

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The laser induced fluorescence spectra of the important free radical, OH, has long been used as a sensitive probe of chemical reaction dynamics of combustion processes. Here, we use both low and high resolution LIF techniques of OH to probe near the transition states of reactions of $O(^3P)$ with CH_4 and SiH_4 in crossed molecular beams and under single collision conditions. The $O(^3P)$ beam source is based on the laser photolysis of ozone (248 nm) in a capillary adapter fitted to a pulsed valve. Both REMPI and LIF methods have been used to fully characterize the source with respect to its temperature, number density and temporal behavior 10 cm downstream of the expansion. Its usefulness as a clean source of $O(^3P)$ atoms is demonstrated in crossed beam studies with silane. Nascent product state distributions and Doppler profiles of OH are obtained using LIF techniques and have given a detailed view of the energy partitioning for this reaction. While similar success has not yet been achieved with CH_4 at a collision energy of $\sim$42 kJ, additional experimental strategies will be explored to initiate this reaction using higher collision energy and/or IR excitation of CH_4 with a NIR OPO prior to collision.