

Here $\nu_1 \equiv k_1[\text{H}_2]$, $\nu_2 \equiv k_2[\text{O}_2]$, $\nu_3 \equiv k_3[\text{H}_2]$, $\nu_4 \equiv k_4[\text{O}_2][\text{M}]$, and $\nu_5 \equiv k_5[\text{CO}]$. Thus the exponential growth constant λ depends on the gas composition and the rate constants of reactions I to V. This paper reports measurements on mixtures chosen to permit determinations of the rates of reactions I, II, III, and V. Mixtures were selected by analyzing equation (1).

EXPERIMENTAL ASPECTS

Growth constants were obtained by measuring the blue carbon monoxide flame band emission behind incident shocks. The intensity of this radiation is proportional to the product of carbon monoxide and oxygen atom concentrations (ref. 3), and since very little carbon monoxide is consumed, the light monitors the increase of oxygen atom concentration with time.

Gas mixtures contained varying amounts of hydrogen, carbon monoxide, oxygen and in some mixtures carbon dioxide, diluted five to tenfold with argon. Hydrogen, oxygen, and argon were high purity tank gases and were used without further purification. Carbon monoxide was condensed at liquid nitrogen temperature; about one-quarter of the condensate was pumped off and discarded. Dry ice served as a convenient source of carbon dioxide. It was purified by subliming three-quarters of a sample into a liquid nitrogen cooled trap. The first quarter of this trapped fraction was discarded and the middle half used for mixture preparation.

Recently we showed that boundary layer effects must be considered in analyzing data obtained behind incident shocks; the growing boundary layer causes increases in temperature, density, and residence time with increasing distance behind the shock. Conditions behind the shocks, in the region of the experimental measurements, were obtained from a computer program which integrated the equations of chemical change for a shocked gas accounting for the effects of boundary layer buildup. In general, the extent of chemical reaction was small, and changes in gas properties were brought about largely by the gas dynamics associated with boundary layer growth.

Exponential growth constants were obtained from plots of the logarithm of observed light intensity against gas time; the relation between gas and laboratory times was obtained from the computer calculations.

SELECTION OF GAS MIXTURES

Let us turn now to the rationale used to select gas mixtures by analysis of