A powder delivery system for the extinction of diffusion flames of condensed fuels is studied.

The main component of the delivery system is a glass elutriation vessel containing a bed of powder. The extinction experiments were conducted in counterflow flame geometry. A flat, laminar diffusion flame was produced in a stagnation point boundary layer by directing an oxidizing gas stream downward onto the surface of liquid fuel burning at atmospheric pressure.

The flame could be extinguished by either decreasing the oxygen mass fraction in the oxidizer stream or increasing the velocity of the oxidizing gas stream. The mass ratio of powder to nitrogen plus powder was maintained at a number of different fixed values to generate extinction curves.

The fundamental measurement taken was the oxygen mass fraction required for extinction as a function of the velocity of the gas stream. Studies were made primarily with the liquid fuel heptane, although the system can be used with other liquid fuels and with solid fuels. The powder tested was alumina, with 90 % by weight of the alumina distribution concentrated in the diameter range of 1.8 - 5.8 mm. At a fixed value of the gas stream velocity, an increase in the powder loading caused an increase in the oxygen concentration at which extinction occurred. The extinction data can be used to extract overall activation energies and prefactors for the inhibition processes in one-step reaction rate approximation, perhaps ultimately leading to conclusions regarding chemical mechanisms for powder suppression.