

SUPER FIRE SUPPRESSANT AGENT

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ABSTRACT

To develop a complex chemical extinguisher, we had to understand the chemical reactions of a flammable material and its relationship to temperature elevation, and to understand the physical model of energy transfer between solid, liquid, and gas phases in a complex fire. Because of the complexity of the physical model and the thermodynamics of heat, we have to work in a one-dimensional energy exchange model and expand from this to a much more complex system of three-dimensional heat dynamics. It is simple to model a two-component heat dynamic system and study the heat transfer by radiation or conduction. In this study we modeled solid-liquid and liquid-gas heat exchange, as well as the liquid-liquid heat model. The results of this study were extrapolated and converted to a three-dimensional energy exchange model, which ultimately helped to formulate a chemical complex to influence heat transmission through the multiphase structure of fire. These results will be presented in future papers. The second part of the present study was mainly chemistry and understanding the chemical oxidation and reduction process that takes place during a complex fire. We will break down this study and summarize it in several sections and concluded with our present understanding of the new fire extinguishing chemicals and their effectiveness.

INTRODUCTION

To date, most commonly used fire suppressants have limited capabilities of suppressing fires. In this study, we have attempted to look more closely at the chemical reactions within a three-dimensional fire as well as at the thermodynamics of heat. The result is the development of a super fire-extinguishing agent able to influence the distribution of heat in a complex fire. This complicated super-agent has the capability of changing the distribution of heat between gas, liquid and solid phases, of reducing the available oxidizing agents, as well as having superior fire retardancy by encapsulating the flammable particles.

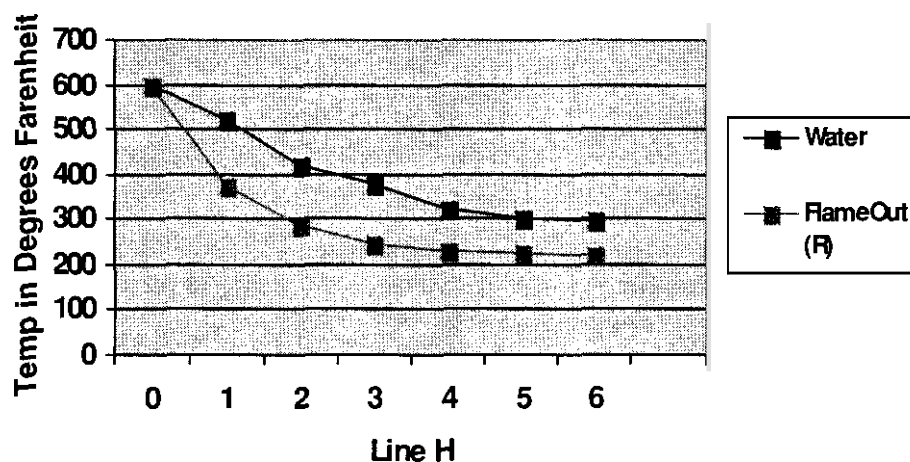
The author has developed a linear or multi-dimensional thermodynamic model for this fire-extinguishing agent, which will be presented in a future paper. This paper is the first presentation of this technology in order to invite collaboration from other researchers and develop a superior fire suppressant technology.

OXIDATION PROCESS AT LOW AND HIGH TEMPERATURES

Low temperature oxidation normally occurs when oxygen, or a strong oxidizer, is present. This type of reaction normally occurs in temperatures below 250 °C. At this stage of the fire, application of any chemical that can prevent the availability of oxygen, or is able to cool the flammable material rapidly, could extinguish the fire. A simple application of water can control the fire. FlameOut® is a water-based chemical and has a cooling effect, enhanced by chemical additives, which give it over 40% more cooling capacity than water. The graph below shows the temperature reduction in a copper tube test using water and a dilute solution of FlameOut®.

HIGH TEMPERATURE AND MATURE FIRES

The fire temperature at this stage exceeds 500 °C and would elevate to a much higher temperature depending on the flammable materials. The chemical reaction in this stage of the fire is unpredictable and very complex. The large volume of hydroxy radicals formed during this stage



of the fire strongly oxidizes any organic matter as well as some metals. FlameOut® has been designed with radical scavenging chemicals, which work similarly to halon extinguishers. The capability of FlameOut® to scavenge radicals generated during the fire has been compared experimentally with the effectiveness of halon in a confined space.

STUDY OF THE INTERFACE OF LIQUID AND GAS

Experimental results have clearly shown that the introduction of FlameOut® to the interface between gas and liquid causes a blanketing effect to control the evaporation of flammable materials. This effect has been studied in six different chemicals with different hydrophilic characteristics; in every case the effectiveness of FlameOut® on the control of vapor has been conclusive.

STUDY OF COOLING EFFECT IN THE LIQUID PHASE

FlameOut® effects, during the penetration in flammable organic solvent, have clearly shown that, in the upper layer of the liquid phase of the flammable organic matter, the temperature is reduced substantially. This process has been studied for two distinct effects of FlameOut®: first, the cooling effect during the sinking of the droplets, and secondly, the emulsification capability of FlameOut® with the liquid molecules, which results in a low temperature bamer with a high heat capacity. The floating emulsion particles have very short lives, but they show outstanding effects on temperature drop at the gas and liquid interface region.

CONCLUSION

The experimental results of the present study will be presented in a future paper. The results, however, are very conclusive and show that a fire extinguishing chemical can be designed to be effective on a very complex fire regardless of the nature of the flammable material and have capability above and beyond existing extinguishers. Such a chemical can be designed to be in full compliance with environmental concerns and safety of use.