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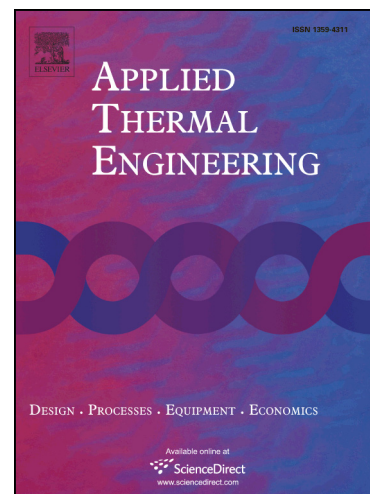
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Active Substances Study in Fire Extinguishing by Water Mist with Potassium Salt Additives Based on Thermoanalysis and Thermodynamics

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Abstract: The active substances during the process of fire extinguishing by water mist with potassium salt additives was studied. The minimum extinguishing concentration (MEC) experiment results showed that K_2CO_3 have the most benefit in improving the fire extinguishing efficiency of pure water with the improving rate of 37.6%, 47.2% and 64.8% which the mass percent was 1%, 2% and 5%, respectively. Other potassium salt additives followed the order by: $K_2C_2O_4 > CH_3COOK > KNO_3 > KCl > KH_2PO_4$, and the reason attributed to the different active substances decomposed from flame temperature by different kinds of potassium salt additives. Thermoanalysis and characterization of the pyrolysis products of potassium salt solutions at flame temperature were analyzed through TG-DSC, XRD, and SEM, the results showed the KOH was the main product in the high extinguishing performance of potassium salts in flame chemical reactions. Thermodynamics analysis by HSC CHEMISTRY showed the K_2CO_3 could provide 4.85% KOH in equilibrium substances, which well above other potassium salts, and other active substances good for fire extinguishing benefited from the intermediate product during the process of the KOH reacted with the flame free radicals.

Key Words: cup-burner; potassium salt additives; fire extinguishing; water mist; active substance; thermoanalysis; thermodynamics

1 Introduction

In recent years, as the rapid development of the economic development, energy has become an important guarantee for the development of energy issues and even directly restricts the economic development. With the increase of population density and building, as well as the increased fuel consumption, fuel structure has been changed, gaseous fuel such as coal gas, liquefied petroleum gas and natural gas gradually becomes the main fuel for city life[1].

However, the widespread use of natural gas increasing the risk of natural gas leakage and fire and explosion accidents. CH_4 fire threatening the life security of the public and causing great damage to the material property. How to solve the CH_4 fire better become the research focus of fire science. Water is a main method for the treatment of fire since ancient times. With the continuous development of society, the fire form is constantly updated, and with the progress of science and technology, the form of water is also constantly innovating. The method of using water to treat fire has been greatly improved, and the water mist is the most representative of fire treatment means[2].

The addition of additives in fine water mist can enhance the fire extinguishing efficiency of pure water according to various studies on the fire extinguishing efficiency of additives [3–9]. In

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