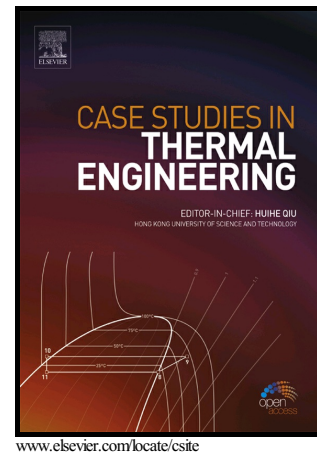


Effect of DPK Flame Retardant on Combustion Characteristics and Fire Safety of PVC Membrane

Yu Xia, Guo qing Zhu, Feng Guo, Yun ji Gao, Hai jun Tao



PII: S2214-157X(17)30147-8
DOI: <http://dx.doi.org/10.1016/j.csite.2017.07.002>
Reference: CSITE198

To appear in: *Case Studies in Thermal Engineering*

Received date: 9 June 2017
Revised date: 5 July 2017
Accepted date: 10 July 2017

Cite this article as: Yu Xia, Guo qing Zhu, Feng Guo, Yun ji Gao and Hai jun Tao, Effect of DPK Flame Retardant on Combustion Characteristics and Fire Safety of PVC Membrane, *Case Studies in Thermal Engineering* <http://dx.doi.org/10.1016/j.csite.2017.07.002>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

(1.School of Safety Engineering, China University of Mining and Technology, Jiangsu Xuzhou 221116, China;

2.Ministry of Education Key Laboratory of Gas and Fire Control for Coal Mines, Jiangsu Xuzhou 221116, China;

3.Fire Research Institute, China University of Mining and Technology, Jiangsu Xuzhou 221116, China; 4.

Division of Mechanical and Space Engineering, Hokkaido University, Sapporo, Hokkaido 060-8628, Japan)

Abstract: In this work, the performances of PVC membrane with DPK flame retardant and without flame retardant were investigated under external radiation flux. The experimental results showed that the addition of DPK flame retardant can greatly reduce the peak heat release, total heat release of the material, and increase the time to peak heat release, time to ignition and the production of poisonous gas CO. By introducing the mathematical evaluation model and specifying the reliable evaluation indexes, the safety indexes of two kinds of materials are obtained. The results showed that by adding the flame retardant, the safety indexes of the PVC membranes were increased to 161% and 156% under 40 kw/m² and 50 kw/m² respectively, which is accordant to the result of experiments and suggest that the presence of DPK has a good flame retardant effect.

Key Words: PVC membrane; DPK flame retardant; Safety index; Cone calorimeter

1. Introduction

Poly Vinyl Chloride (PVC) membrane is a major membrane material found in membrane structure architectures such as exhibition, exposition and temporary buildings[1, 2]. The Poly Vinyl Chloride (PVC) membrane is a composite containing several different components, PET, PVC, PMMA or PVDF[3, 4]. The combination of these thermoplastic polymers gives rise to composites having the best properties of each component[5]. However, as we all know most of the conventional polymers are based on hydrocarbon backbone, which pose a fire hazard[6]. Buildings in public places have strict requirements for fire-retardant grade, so it is necessary to test and evaluate the flame-retardant properties of PVC membrane materials before using for construction. Pure PVC has fire retardant property indeed, while additives (e.g. plasticizer, binder) to PVC products for applications can reduce the fire retardancy significantly even becoming flammable. In addition, as aging process of the coating material on PVC membrane caused by exposure to external radiation and light, some performances such as combustion properties may also change. Therefore, it is necessary to study the effect of flame retardant on fire behavior of Poly Vinyl Chloride (PVC) membranes.

In the structure of the membrane material, the coating and the substrate occupy a larger proportion. The weight of the fabric base and the main coating generally accounts for more than 90% of the total weight of the whole membrane, and the proportion of the base fabric is less than 20%. The weight of main coating accounts for not less than 70%. The surface coating of PVC composite membrane has an important influence on the flame retardancy of PVC membrane.

Many researches has been carried out to study the fire behavior of membranes. Patrick Van Hees, Per Blomqvist [7] described a summary of regulations and test methods which can be applicable for technical textiles when used in buildings and divided the test methods into small-scale tests, intermediate scale tests and even large scale tests. Per Blomqvist [8] studied fire performance of a number of textile membranes using European classification test and large scale reference room test. Per Blomqvist and Maria Hjohlman [9] conducted fire tests with textile membranes on the market by using of cone calorimeter and SBI testing methods. Petra Andersson and Per Blomqvist [10] carried out large-scale tests conducted with textile membranes. At the same time, many researches has been carried out to improve the flame retardancy of PVC materials by adding inorganic flame retardants, such as Sb₂O₃, ZHS, Al(OH)₃, Mg(OH)₃, and organic flame retardant plasticizer [11-14]. And there are researches conducted to study the flame retardant of membranes. R Dombrowski outline the basic principals of flame retardant technology of textile coating. S. Hun had illustrated flame resistance performance of basalt or glass woven fabric [15, 16]. Sujing LIU conducted experiments to research on the

Download English Version:

<https://daneshyari.com/en/article/7153462>

Download Persian Version:

<https://daneshyari.com/article/7153462>

[Daneshyari.com](https://daneshyari.com)