

FIRE SAFETY IN KARAOKES: SURVEY ON AVAILABLE FIRE RETARDANT FR COATINGS

J. Hao

National Laboratory of Flame Retardant Materials, School of Chemical Engineering and Materials Science
Beijing Institute of Technology, Beijing, China

W.K. Chow

Department of Building Services Engineering, The Hong Kong Polytechnic University, Hong Kong, China

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ABSTRACT

Timber products were commonly used for partitioning those karaoke boxes built several years ago. Whether the timber materials are treated with suitable fire protection treatment is a question. This is very dangerous and the combustible materials should be replaced as soon as possible. However, it is too expensive to remove and replace all those partitions by non-combustible materials such as fire-rated gypsum plaster boards. Further, normal operation of the business will be seriously disturbed. Under this economic environment, this should not be recommended as the unemployment rate of 6.7% might be further increased. But adequate safety must be provided to the public. Therefore, in addition to implement proper fire safety management immediately, fire retardant (FR) coatings should be considered for applying on the partition boards. Commercial FR coatings suitable for use in karaoke establishments with wood partitions are reviewed. This will give a brief introduction on what FR coatings are.

1. INTRODUCTION

Consequent to an arson fire in a karaoke [1] and several other big fires, citizens are quite concerned about the fire safety provisions for buildings in Hong Kong. Government departments are worrying about the fire safety in karaokes and thus new codes to upgrade their safety provisions are proposed [2,3]. Upon smooth reunification to China in 1997, the new Special Administrative Region (SAR) government is very open in accepting comments from the society. Codes will not be set up without consultation. In fact, the Karaoke Establishments Bill (KEB) [3] was turned down several times at the Legislative Council. This is a good indication of how open the SAR government is in accepting criticisms. It is obvious that long-term research has to be carried out before setting up workable fire codes [4].

Wood partitions [5,6] were used for karaoke establishments built several years ago. Before that time, gypsum plaster boards were not so popularly used. Flame spreading over wood partition without fire protection treatment should be watched carefully. Specifying only the fire resistance requirement for karaoke partition in the new KEB is insufficient [3]. Since public safety is of the most concern, this problem must be solved as soon as possible. Obviously, new karaokes are not allowed to have non-fire-rated wood partition

materials. Even those wood partitions in existing karaokes should be replaced as soon as possible. However, the refurbishment work is far too expensive. Disturbance to normal business operation will further increase the unemployment rate, which is staying a high value of 6.7% at the moment. At this transition period of verifying the proposed KEB [3] is good by full-scale burning tests [7], in addition to fire safety management [4,8,9], applying fire retardant (FR) coatings seems to be a good solution and is proposed to be used for providing fire safety [10]. Detailed information on FR coatings [11] can be found easily on the internet. Products which might be of interest for use are described in this paper. The objective is to provide a general picture for those who have the responsibility to upgrade fire safety.

The following products are reviewed:

- Water Based Intumescent Coatings
- Non-Intumescent Coatings
- Solvent Based Coatings
- Powder Intumescent Coatings

2. WATER BASED INTUMESCENT COATINGS

Three products are reviewed:

- Product A

This product can provide good fire protection to the substrates. The coating would expand up to 100 times of its dry film thickness when exposed to fire, giving a thick insulating barrier. When tested under ASTM E 84 [e.g. 12], it gave a flame spread index of 5 and a smoke developed index of 40. It can be applied to different types of porous or non-porous materials, such as wood (raw or painted), metal, solid and foam plastic materials. Application may be accomplished by brush, roller and spray methods. The coverage rate is from 150 to 350 ft²/gallon, depending on the area of application.

- Product B

This product is of latex type, pigmented intumescent coatings for interior combustible surfaces. It can be used in residential, commercial, public and industrial buildings. It has a low volatile organic compounds (VOC) range of less than 201 g/L, and is assessed to have a “three tree” environmental-friendly icon.

- Product C

This product is of appearance similar to ordinary latex base paint. Upon exposure to flame or heat, it would swell to give an effective thermal insulation layer to protect the substrate. This product can be applied to many types of surfaces and give an attractive appearance. Further, applying several coating layers of latex base paints, urethanes or acrylics would give resistance against weathering.

3. NON-INTUMESCENT COATINGS

- Product D

This product had been tested on coating over Douglas Fir Substrate under UL 723 [13] to give a flame spread index of 35 and a smoke developed index of 95. The rate per coat of the samples tested is 330 ft²/gallon. It can be used on any type of unpainted wood and many other cellulose materials, such as fir, cedar, redwood, pine, straw, paper/cardboard and wall coverings. This product can be applied by brush, roller and spray methods. The coverage rate is from 150 to 350 ft²/gallon, depending upon the results desired.

- Product E

This product is a ready-to-use sprayable coating for cable. It adheres to any surface and is safe for all types of cable insulation. There are no solvents, plasticizers, asbestos or other hazardous inorganic fibers. Under common tests, it gave a Limiting Oxygen Index higher than 40; ASTM E 84 of flame spread index less than 10; and smoke developed index less than 30. This cable coating is suitable for both interior and exterior applications. It is resistant to ultraviolet UV radiation, and is basically not affected when exposed to other radiation.

- Product F

This is an environmental-friendly product which is non-hazardous and biodegradable. It is an aqueous solution of inorganic materials formulated to provide a flame retardant which can stand temperature above 1900°C before ignition. This is achieved by incorporating a blocking mechanism, which inhibits the flame penetration to the substrate materials. When properly applied to porous substrates, a class A fire retardancy is provided. There is no visible effect on the substrates. The coating would not change the texture and properties of the substrate. It can be applied to wood surfaces, carpets, draperies, upholstery, paper products, cardboard, fabrics (cotton, polyester, velour, etc.) and all other porous materials.

4. SOLVENT BASED COATINGS

- Product G

This is a solvent based modified alkyd type, pigmented coating and has passed the UL code. It can be used for interior combustible surfaces such as ceiling tile, wood and particleboard. This product has a lower VOC range from 401 to 450 g/L, and is assessed to have a “two tree” environmental-friendly icon.

- Product H

This product would expand to form an insulating char when exposed to elevated temperatures. It is suitable for protecting structural wood and steel. It has a fire rating of 60 minutes, fire protection of timber – “0” flame spread rated Class 1 in accordance with South African Bureau of Standards (SABS) 0177 part 3.

5. POWDER INTUMESCENT COATINGS

This product was developed based on non-halogenated phosphate technology. A coating of 3 mm thick would expand up to 38 mm char upon heating or when subjected to a flame. This char barrier will extinguish fire and prevent further spreading of flame. The protective char barrier can withstand direct flame from a propane torch for longer than 1 hour. This product can be added into the epoxy containing no VOC, or a unique two part phenolic coating, or a one component latex coating. Other advantages are low flame spread rate, low smoke toxicity, not containing fungicide and not supporting microbial growth, no leaching out over time, excellent adhesion, scratch resistance and wearability. It is recommended for coating wood, composites, plastics and metals. In comparing with other flame retardant coatings, the total cost is not so expensive because it can be applied easily.

6. CONCLUSION

It has been pointed out that using non-fire-rated timber partition is dangerous [5]. The materials can be ignited easily by an adjacent burning item such as polyurethane foam sofa. Flame can spread over the timber corridor rapidly. Providing smoke management system [14,15] might be a solution but there are associated technical problems. At this economic condition, it is not practical to remove and replace all the wood partitions by non-combustible materials. In addition to fire safety management [4,8,9], applying FR coatings over the timber surfaces is a good solution. Products reviewed in this paper will help owners to select suitable FRs products for their own karaokes.

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