The American Journal of Interdisciplinary Innovations and Research
(ISSN–2642-7478)
Published: January 23, 2021 | **Pages:** 19-24
Doi: https://doi.org/10.37547/tajiir/Volume03Issue01-03

IMPACT FACTOR
2021: 5. 676
OCLC - 1091588944

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The Application Of Intumescent Compounds As A Means Of Providing Fire Protection Of Building Materials

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ABSTRACT

The research paper analyzes the use of intumescent compounds as a means of providing fire protection for building materials. The need to use lightweight coatings is indicated. Along with other intumescent compositions developed in a number of foreign countries, the author pays special attention to the experience of American specialists who have developed a method for producing mixed compositions from silicate materials with fillers in the form of mica and vermiculite, characterized by increased porosity and intended for use in the manufacture of fire-resistant building products and fire retardant coatings. for building structures.

KEYWORDS

Refractoriness, building materials, vermiculite, intumescent compounds.

INTRODUCTION

The use of intumescent compositions today is one of the most intensely hazardous materials in the field of fire protection of building structures and materials. This is due to the fact that the intumescent coating is applied in a relatively small layer, which, in its current state, performs complex physical and chemical processes, transforming a thin layer of a fire-retardant coating into a thick heat-insulating

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layer, which limits the further spread of the front of elevated temperatures.

In recent decades, many new fire retardant materials have found widespread use for protecting metal structures. The range of fire and heat-shielding materials has expanded significantly. A large number of various compositions of fire retardant intumescent coatings based on mineral and organic binders have been developed.

They are applied to the surface of metal structures with a thin layer from 1-2 to 5-6 mm thick. At temperatures of the order of 200-500 ° C, they begin to swell and form a porous thermal insulation layer up to 3-4 cm thick and more. The formation of a porous layer with low thermal conductivity prevents rapid heating of the protected elements.

It is, as a rule, a multiphase system of organic and (or) inorganic components. Of the mineral binders in intumescent compositions, soluble water glass is most often used, which is an aqueous solution of sodium or potassium silicate. An increase in the water resistance of soluble glass is achieved by adding sodium fluorosilicate, Portland cement, ground blast furnace slag, etc. Compositions of cement-perlite and other types of low-density plasters have been developed. Fire protection using such lightweight coatings (density 200-300 kg / m3) is an effective way to increase the fire resistance of structures.

METHODS OF RESEARCH

World practice shows that today in the market of fire retardant materials with the greatest demand are used fire retardant paints and varnishes (LKM) for fire retardant paints and varnishes, as they are environmentally friendly and safe, do not harm the environment and human health during production and use.

As already noted, one of the most often used as an inorganic binder to obtain fire retardant paintwork materials is water glass, in addition. Of these, the most affordable is sodium water glass. In addition to availability, liquid glass has a number of advantages over cement, phosphate and other binders. It is non-toxic, high adhesion to steel and the ability to expand in volume when heated.

In addition to the above advantages, liquid glass (especially sodium glass) has a number of disadvantages that hinder the production of effective fire retardant coatings, which can be eliminated by modifying them in various ways.

Of the work on the creation of passive fire protection means, the development of the following manufacturing countries deserves special attention: Great Britain, Germany, the Netherlands, the USA, Japan, the Republic of Korea, Russia, etc.

Currently, Russia is actively and steadily introducing fire-retardant products of such manufacturers as "Association Krilak", "Research and Production Laboratory 38080", "Teploognezashchita" (Sergiev Posad), NPP "Techservisvermikulit" (Chelyabinsk), LLC " EnCentre "Morning", "NEOCHEM", "Scientific Innovation Center for Construction and Fire Safety" (St. Petersburg) and many others. Of the Russian developments in the field of fire retardant materials, the following can be cited: developed (Chelyabinsk) a vermiculite coating with a binder of soluble glass of the OPV-TSV brand and a heat-insulating sprayed coating (coating) based on light vermiculite and a modified cement binder.

A fire-retardant mastic "Phoenix PVU" was obtained on the basis of an aqueous dispersion of a synthetic film-former, intended for filling seams and cracks of fire-retardant monolithic and prefabricated structures, sealing joints during the installation of fire-retardant products. The developed thermo-expanding water-based fire retardant composition "Phoenix SE" is intended for fire protection of cable products, as well as for the protection of steel structures. Fire retardant thermo-expanding composition "Phoenix STV" on a water basis is designed for effective fire protection of steel building structures. It is advisable to use Phoenix STV at operating enterprises with a permanent presence of people and increased requirements for explosion and fire safety, in rooms with limited ventilation and special sanitary and epidemiological requirements.

On the basis of liquid glass, several types of fire-retardant coatings have been developed in Russia: OFP-MM, OFP-MV, OFP-10, OFP-11 and many other compositions. These formulations differ mainly in the different types of fillers, additives and hardeners. They have a low average density, low thermal conductivity, and have high fire-retardant properties.

Of the domestic developments in the field of fire retardant materials based on local mineral raw materials, the mineral vermiculite, the works of the authors P.A. Aripov, Sh.E. Kurbanbaev, B.T. Ibragimov and others deserve attention, where the development of fire retardants for various surfaces is described.

Analysis of literature sources shows that in recent years there has been a tendency to increase interest in the creation of fire retardants for metal structures, in which the effect is achieved due to:

- High-temperature inorganic binders: alumophosphate, alumoborophosphate, alumochromophosphate and others, compatible with components such as titanium dioxide, magnesium oxide, silicon dioxide, aluminum hydroxide;
- High-temperature organic binders - urea-formaldehyde or urea-melamine-formaldehyde resins;
- Fire retardants: ammonium polyphosphate, alkylphosphonic acids, etc.;
- Special intumescent components - oxidized graphite, polystyrene waste, etc.

Compositions based on phosphate binders, mineral porous aggregates and fibrous materials constitute a significant group of fire retardant coatings. The content of phosphate binder in them is in the range from 16 to 85%. Binder consumption is determined by the type of filler and its porosity.

Many of these materials contain polyammonium phosphate, monoammonium phosphate and urea phosphate as fire retardants. The main disadvantages of these formulations are their low water resistance due to the presence of soluble phosphates, rapidly changing viscosity due to chemical interaction, which makes mechanized coating difficult, and toxicity when heated.

To increase the fire resistance of metal building structures, fire retardant coatings have been developed based on the silicophosphate binder ESMA (TU OYAD.503-091-92) and OZS-MV (TU 09.093-92), as well as phosphate coatings OFP-43 11 and OFP-MM [1, 2,3,4,5]. The latest flame retardants are highly effective fire protection for both wood and metal structures. The mechanism of the fire-retardant effect of the coating is that when exposed to high temperatures, they form a heat-insulating foam material. This occurs, in particular, due to the introduction into the composition of solid salts of orthophosphoric acid, which, interacting with aluminum oxide, which is part of the pearlite, form a number of phosphate salts. This occurs, in particular, due to the introduction into the composition of solid salts of orthophosphoric acid, which, interacting with aluminum oxide, which is part of the pearlite, form a number of phosphate salts.

In many developments, expanded perlite, vermiculite, hollow phosphate microspheres, waste polyurethane and expanded polystyrene foam, asbestos, kaolin, mineral and glass fibers and other fillers were introduced into the initial composition to improve the thermal insulation properties of fire retardant coatings.

Hollow phosphate microspheres increase the mechanical strength by creating a rigid skeleton in the coating and provide high thermophysical characteristics of the coating.

In combination with heat treatment of a finely ground mixture of clay and a phosphate binder, a homogeneous material is obtained, characterized by a lower amount of internal stresses, and also allowing to reduce the content of the phosphate binder and bivalent metal oxides in the composition.

Chrysotile asbestos, mineral wool and fiberglass are used as fibrous fillers. Such fillers are highly effective lightweight fire retardant materials due to their incombustibility, inertness and low thermal conductivity. Additions of alumina, chamotte, magnesite, and ground blast furnace slag increase the refractoriness and reduce the shrinkage of the fire retardant.

British specialists (NuUifire Ltd., Great Britain) have developed a number of water-based intumescent fire retardant materials for coating steel building structures. For example, the material System-S607 is low-toxic, characterized by low odor intensity, safe handling and therefore can be easily used in food and other types of industries. With its help, the fire resistance of steel structures is provided up to 90 minutes. The material is applied to the protected surface by spraying, or with a paint roller and brush. Each layer provides a fire resistance limit of 30 minutes.

You can cite the work of the following manufacturers from Germany:

- The company "AEG Jsolier-und Kunstoff GmbH" produces fire-retardant coatings based on fiberglass, glued to the surface using a special glue that expands under the influence of temperature;
- ZM company produces fire retardant paint, which swells 20 times with a coating thickness of 1 mm and provides a fire resistance limit of 30 minutes, with a thickness of 2.6 mm - 180 minutes, is used for cable products made of metal, plastics, located indoors. The advantage of the coating is to provide a sufficiently high fire resistance limit with a paint layer thickness of 1 mm. The disadvantage is the effects of moisture.

On the basis of aluminosilicates and a heat-resistant filler made of aluminum oxide, Japanese companies have developed a fire-resistant composition "Seratayka", intended to increase the fire resistance of reinforced concrete beams and columns. The composition is applied by wet shotcrete, the hardening time is 1-2 hours. The «Seratayka» coating is characterized by:

- High strength and hardness;
- Significant strength of adhesion to the reinforcement, which is preserved under fire conditions;
- Anti-corrosion properties in relation to fittings, which eliminates the need for additional anti-corrosion protection of fittings. The fire resistance limit of reinforced concrete structures with reinforcement coating thickness of 20 and 35-40 mm is 1 and 2 hours, respectively.

American specialists have developed a method for producing mixed compositions of silicate materials with fillers in the form of mica and vermiculite, characterized by increased porosity and intended for use in the manufacture of fireproof building products and fireproof coatings for building structures. In contrast to the previously known methods, this method allows you to obtain uniform microporosity of materials with closed pores, which is important for increasing their moisture resistance and heat resistance.

Also, in the United States, an effective fire-retardant coating has been developed for steel load-bearing building structures, which is sprayed on their surfaces and consists of inert heat-insulating materials with a thickness of 16 mm to 32 mm, which is enough to ensure the fire resistance of structures is 1 hour.

The average density of the material varies from 0.5 g / cm3 to 1.9 g / cm3. The composition of fire retardant materials includes the following components:

- Special grade of cement;
- Emulsifying resin;
- A mixture consisting of 15-85% aluminum hydroxide powder and 85-15% carbonate, decomposing at temperatures from 300 to 1000 ° C;
- Lightweight filler [7,8,9].

Thus, the process of creating new modern effective means of fire and heat protection occurs continuously, since each of these means has its own positive and negative properties and indicators, which are being improved and developed in the direction of ensuring the main criteria, such as the duration and effectiveness of fire protection, an increase in the service life of objects under normal operating conditions and the minimization of the cost of the product being developed.

At present, despite the available range of fire and heat-proof materials offered in the construction markets of the world and the republic, the creation of new effective protective materials with complex functionality is an urgent task.

CONCLUSION

The reason for this is that in the republic the main part of the fire-retardant materials used in the construction of objects for various purposes is either imported in full, or manufactured according to the technologies of leading foreign companies with a recipe, providing for the maintenance of a whole range of various imported additives, the cost of which makes up the bulk of all raw material costs. And also research in the field of creating new fire and heat-resistant materials is still carried out using harmful chemical compounds. At the same time, in research work, the issues of obtaining fire retardant coatings of complex functionality based on mineral components have been insufficiently studied.

REFERENCES

1. Leonovich AA. Fire retardant efficiency of phosphate-nitrogen-containing fire retardants depending on the chemical nature of the nitrogen-containing component // Chemical Industry. 2003. T. 80, No. - S. 8-12.
2. Nenakhov S.A., Pimenova V.P. Physical chemistry of foaming fire retardant coatings based on ammonium polyphosphate (literature review) // Pozharovzryvobezopasnost. - 2010. Volume 19.- №8.- S. 11-58.
3. Korolchenko A.Ya., Korolchenko ON. Means of fire and biosecurity. - Ed. 3rd, rev. And add. - M .: Publishing house "Pozhnauka", 2010. - 250 p. ill.
4. Smirnov N.V. Forecasting the fire hazard of building materials. Dissertation. ... Dr. Tech. Science. - Moscow. 2002 .-- 273 p.
5. Mirzaev S.Z., Kurbanbaev Sh.E., Muzafarov U.T. BLOW-UP FIRE-PROTECTIVE COMPOSITIONS: Structure and thermophysical properties // Monograph, Germany. LAP LAMBERT Academic Publishing, Saarbrücken, 2015.- 129 pp.
6. Airlaced vermiculite concrete for insulating and fire-proofing. – Pit and Quarry, 1953. – Vol. 45, № 12. – 163 p.
7. Ashton L. A. Vermiculite as fire protection for structural steel/ Ashton L. A. Civil Engineering. – 1955. – Vol. 50, № 586, – P. 403–405.
8. Fire resistant compositions and laminates: Advence 2255560 Gr. B, МКИ5 C 08 К 5/ 55, В 32 В 17/10, В 32 В 27/ 38/ Varma K. S., Parkes D. P.; Pilkington Pic. № 9203420.6; Stated. 18.02.92; Publeshed. 11.11.92; НКИСЗВ.