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Examination of Flammable and Heat Protective Polymer Composite Coatings Using Oxygen Index Determination

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Abstract. *This article discusses the effect of fire-retardant expanded polymer coatings based on an acrylic copolymer on the oxygen index of polymer binders, flame retardants, gas-forming expanded-active chemical additives and fillers in a ratio of 5-42% at a temperature of 200-300* ^{0}C.

Key words*: acrylic copolymer, construction, polymer binder, oxygen index, composite, convex coating, antipyretic.*

Introduction

In researching the oxygen index of fire-resistant and heat-protective polymer composite coatings, test experiments were carried out to determine the oxygen index based on the results of calculating the amount of oxygen concentration in the mixture of oxygen and nitrogen by burning a specially prepared polymer composite. Determination of the oxygen index of heat-protective polymer composites based on acrylic copolymers was carried out as follows. According to it, a polymer composite sample was prepared based on GOST 12.1.044-2018 and GOST 21793-76. The oxygen index of the finished samples was started with a 19.5% oxygen mixture.

The oxygen index (OI) is calculated from the following expression in percent.

$$OI = \frac{V_k}{V_k + V_a} \cdot 100 \qquad (1)$$

here:

V_k – total oxygen in dm^3/minute or cm^3/s; V_a – total amount of nitrogen in dm^3/minute or cm^3/s. Based on this expression, the average values of the oxygen index were determined.

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Figure 1. Laboratory procedures for researching the oxygen index of fire-resistant and heat-protective polymer composite coatings.

The investigation of the qualities of fire-resistant corrugated coatings, which are commonly employed to protect reinforced concrete structures from high temperatures and flames, is now frequently done using the oxygen index. The suggested polymer composite materials have a OI of 18–19% prior to composite production. In light of this, freshly made polymer composites including OI 19–4% oxygen and nitrogen molecules were investigated.

High-temperature pyrolysis and combinations of refractory chemicals are two crucial aspects in the creation of flame-resistant and heat-protective polymer composites, and the proper selection of composites is essential. Because they have different thermal-oxidation properties and the influence of different factors on their kinetics and mechanisms, acrylic copolymer-based fire-resistant and heat-protective coatings, which are currently used widely in reinforced concrete structures, call for further development of scientific research pertaining to these polymer composites. The impact of polymer binders, flame retardants, chemical additives that emit gas when exposed to temperatures between 200 and 300 oC, and fillers in the range of 5 to 42% on the oxygen index was investigated in accordance with the functioning mechanism of fire-resistant and heat-protective polymer coatings. The following is the impact of the suggested compositions' percentage (%) ratios on the oxygen index:

acrylate copolymer-based polymer covering that is fire- and heat-resistant

Polymer binder

acrylic styrene copolymer (AK-777)..33

vermiculide...33,1

aluminum hydroxide...3,6

Fluxing additive

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Tough glass...29,2

Fire retardant

carbomed..1,1

On the basis of acrylic copolymers, it was investigated how the oxygen index was affected by various flame retardants comprising metal, boron, phosphorus, nitrogen, bromine, chlorine, and other elements. In the course of the research, oligomeric flame retardants made from acrylonitrile with phosphorus- and nitrogen-containing compounds, flame retardants imported from abroad (Pirilaks), and flame retardants of the AR-10 and MMA brand developed by scientists in our Republic were taken and analyzed in various proportions in the creation of polymer composite coating. It states that the composition of the suggested fire-resistant and heat-protective polymer coating based on acrylic copolymers was analyzed, and it was found that the oxygen index of the ratio of 35% flame retardant to 42% is equal to 42%. These proportions of 5-40% oligomeric fire retardants were obtained on the basis of acrylonitrile with compounds containing ammophos and borax. In the experiments, it was determined that adding more than 35% of a flame retardant would result in an oxygen index of 45% or higher, but the ratio of 35% was found to be effective due to the adverse impact on the polymer composite's physical and mechanical properties, meaning that it does not meet the required standards.

It was discovered that oligomeric fire retardants of the ARM-1 brand are more effective than analog fire retardant bought from overseas (Pirilaks), as well as the AR-10 and MMA brand fire retardants developed by scientists in our Republic.

The effect of mixture percentages based on polyphosphate ammonium (PFA), ammophos, cyanuric acid, melamine, graphite, and pentaerythritol on the oxygen index was investigated in the process of creating flame-resistant and heat-protective polymer coatings based on acrylic copolymers. The swelling characteristics of the polymer composite were investigated after adding 5–40% of the suggested mixture of ammonium polyphosphate, melamine, and pentaerythritol in the ratio of 1:1:0.5. Similar to these mixes, 5–40% of an amphos, cyanuric acid, and graphite mixture in a 1:1:1 ratio was added to the polymer composite. Graphite, pentaerythritol, and PFA in a ratio of 1:0.5:1, as well as cyanuric acid, graphite, and pentaerythritol, in a ratio of 1:1:1 were studied. Figure 3 shows the outcomes of this test trial. In comparison to previous proposed combinations for convexity, the results collected demonstrate that the addition of polyammonium polyphosphate, melamine, and pentaerythritol to the polymer composite at a ratio of 25% resulted in an oxygen index of 42% and higher.

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So, for fire resistance and bulging qualities of fire-resistant and heat-protective polymer composites based on acrylic copolymers, the addition of chemical additives with flame retardant and bulging properties in general from 10-15% to 30-35% assures a favorable outcome.

References:

1. ГОСТ 12.1.044-2018 Единая система защиты от коррозии и старения покрытия лакокрасочные. Общие требования и методы ускоренных испытаний на стойкость к воздействию климатических факторов. Издание официальное Москва Стандартинформ 2018 г. С. 122.
2. Murtazaev K.M., Nurkulov F.N., Mukhiddinov D.N. Abdirova M.T. Research of new fireproof supplied polymer composites based on epoxy resin for metal structures. The ministry of higher and secondary-specialized education of the republic of uzbekistan tashkent state technical university named after Islam Karimov “Technical science and innovation” 2021, №4(10). P. 19-25.
3. Муртазаев К.М., Мухиддинов Д.Н., Нуркулов Ф.Н., Джалилов А.Т. Антикоррозионные полимерные химически стойкие покрытия на основе эпоксидных олигомеров. Узбекский Научно-технический и производственный журнал Композиционные материалы №4/2020 С 76-78.
4. ГОСТ 21793-76 Группа Л08 Государственный стандарт союза сср пластмассы. Метод определения кислородного индекса. С. 14.
5. Муртазаев К.М. Эпоксид смоласи асосидаги ёнғиндан ҳимояловчи қаварикланадиган полимер композит қопламаларни кислород индексини тадқиқ этиш. «Пожаро-взрывобезопасность» научно-практический электронный журнал – Ташкент, 2022. - №1(8). - С. 47-55.
6. Муртазаев К.М., Мухиддинов Д.Н., Нуркулов Ф.Н. Исследование механизма огнезащитных вспучивающихся покрытий на основе акриловой смолы // Узбекский Научно-технический и производственный журнал Композиционные материалы №2/2021 С 11-14.
7. Муртазаев К.М., Мухиддинов Д.Н., Нуркулов Ф.Н. Химические стойкие композиционные материалы на основе акрилового покрытия // Фарғона политехника институти. – Фарғона, 2021. - Том 25 №2. – С. 150-154