Materials Science Forum
ISSN: 1662-9752, Vol. 1006, pp 62-69

Submitted: 2020-03-30
Accepted: 2020-03-31
Online: 2020-08-07

Study Insulating and Cooling Properties of the Material on the Basis of Crushed Foam Glass and Determination of its Extinguishing Characteristics with the Attitude to Alcohols

Alexander Kireev[1,a], Dmitry Tregubov[1,b*], Serhii Safronov[1,c] and Dmitry Saveliev[1,d]

[1]National University of Civil Defence of Ukraine, 94, Chernishevska str., Kharkov, Ukraine, 61023

[a]53kireev@gmail.com, [b]1970tregubov@gmail.com, [c]kozerog70@ukr.net, [d]saveliev.dmitriy86@gmail.com

Keywords: two-layer insulating-cooling material, granular dry and wetted foam glass, gel-like layer, alcohol quenching, buoyancy.

Abstract. To extinguish alcohols, it is proposed to use a two-layer material consisting of a layer of a light porous carrier, on which an insulating gel layer is applied. The use of crushed foam glass as a porous carrier is justified. To obtain an insulating layer of gel, it is proposed to use a gel-forming system $CaCl_2 + Na_2O \cdot 2.7\ SiO_2$. The insulating and cooling properties with respect to the alcohols of two separate layers and the buoyancy of a crushed foam glass layer are determined. The cooling properties of the two-layer foam glass - gel material were evaluated. To increase the cooling properties of the foam glass, it is proposed to wet it. It was found that, at the same time as the cooling effect increases, wetting of the foam glass leads to a decrease in its buoyancy and insulating properties with respect to alcohol vapors. The heights of dry and wetted foam glass layers necessary to stop the combustion of one, two, and three atomic alcohols were experimentally determined. It is concluded that alcohols can be quenched with dry and moistened foam glass, both with a gel layer applied to its surface and without a gel layer.

1 Introduction

Worldwide fire statistics show a high prevalence of fires involving flammable liquids [1-2]. At present, the extinguishing of flammable liquids is one of the most difficult problems of fire extinguishing [3-4].

Among a wide variety of flammable liquids, alcohols occupy a special place, while they are one of the most common among the class of polar liquids. This is also facilitated by the fact that alcohols are components of mixed fuels, which also apply to polar liquids. Quenching of polar liquids is very difficult and when using many fire extinguishing agents it requires additional technical and technological solutions [5].

Despite the fact that practically all types of extinguishing agents are allowed for extinguishing alcohols [5-6], to date, only foams of special purpose have been recognized as an effective universal agent of extinguishing them. To obtain extinguishing foams based on alcohol-resistant foaming agents labeled “AR” (“alcohol resistant”) or “ATC” (“alcohol type concentrate”), requires the introduction of fluorine-containing surface-active substances in their composition, which have low environmental and economic parameters [6-8].

One of the significant disadvantages of foams is their low resistance. They are destroyed when exposed to intense heat fluxes from a flame of a burning liquid and from the contact of the foam with a number of flammable liquids, especially polar ones. This requires the supply of large volumes of foam, which affects the economic characteristics of air-foam extinguishing media. Also, the use of foams for extinguishing alcohols leads to their pollution and the impossibility of further targeted use. What further worsens the economic characteristics of air-foam extinguishing agents during alcohol extinguishing.

Thus, the issue of stopping the burning of alcohol-containing liquids does not currently have a comprehensive solution, which makes it urgent to develop fundamentally new fire extinguishing agents for these purposes.

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