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PEROXIDE FOAM CONTAINER

Abstract

A pressurised container containing a foam-forming aqueous composition is herein described. Uses of said pressurised container and methods for stabilising a foam-forming aqueous composition are also herein provided.

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Background/Summary

FIELD OF THE INVENTION

[0001] This invention relates to a pressurised container in which a foam-forming aqueous composition comprising one or more peroxides is retained.

BACKGROUND

[0002] Peroxides are effective broad-spectrum biocides which are used to disinfect surfaces, materials and equipment contaminated by bacteria, fungi, viruses, amoebae, and other pathogens. In some cases, they are also capable of removing biofilms. Hydrogen peroxide in particular is a desirable disinfectant because it forms no harmful by-products, is PH neutral when dosed, and is odourless and colourless. After disinfection, it degrades into water and oxygen. Peroxides are relatively unstable due to the presence of the oxygen-oxygen bond which makes them prone to decomposition and affects their shelf life and longevity. Factors such as high concentration, elevated temperature and exposure to light can accelerate decomposition and have to be controlled in order to prolong the storage life of peroxide products.

[0003] Peroxide solutions are generally stored in unpressurised containers due to the unavoidable evolution of oxygen that occurs during decomposition. This can potentially lead to rupture of the container in which the solution is held or combustion of the evolved oxygen gas, both of which pose a hazard. Despite this risk, it may be advantageous to use pressurised solutions of peroxide disinfectants, for example, to produce a foam disinfectant.

[0004] Previous attempts to store peroxide compositions have been unsatisfactory. In some instances, inert coatings have been used inside peroxide containers, but they are generally only present on some surfaces. Other surfaces, particularly those that are difficult to coat satisfactorily, are ignored. Although this approach can be useful for short term storage, or applications where the concentration of peroxide is not crucial, such an approach is not appropriate for storing sterilizing peroxide compositions for a period of years, where it is important to maintain a constant concentration of peroxide for sterilizing efficacy after prolonged storage. Research has frequently taken scientists in other directions to address the problems of storing substances that evolve oxygen and other gases. For example, JPH09104487A discusses the problem of pressure increase inside a container storing a compound capable of evolving oxygen. Rather than seeking to prevent this decomposition, the applicant provided a jacketed container in which the gap between the inner and our walls was at least partially filled with a gas absorbent. The stated objective was to suppress pressure increase by absorbing evolved decomposition gases, rather than suppressing the actual evolution. Therefore, there remains a need to provide a means of storing a pressurised peroxide solution which alleviates the aforementioned degradation problem at least to some extent.

SUMMARY OF THE INVENTION

[0005] In accordance with a first aspect of the invention, there is provided a pressurised container containing a foam-forming aqueous composition comprising one or more peroxides, wherein an internal surface of the container is coated with a polyamide-imide (PAM) coating.

[0006] Advantageously, the PAM coating provides a stabilising effect on the peroxides which permits the composition to be stored for extended periods of time without appreciable degradation of the one or more peroxides. The PAM coating provides a barrier between the container wall and composition which, in embodiments in which the container comprises a metal, avoids metal-catalysed decomposition of the peroxide.

[0007] The stabilising effect of the PAM coating may permit the peroxide composition to be stored at elevated pressures without a risk of decomposition of the peroxide and the consequent evolution of oxygen gas. This allows the container to be pressurised with minimal risk that the container will rupture during transport or storage.

[0008] The one or more peroxides may comprise at least one of hydrogen peroxide, peracetic acid, performic acid, peroxymonosulfuric acid, acid, and peroxymonophosphoric acid. For example, the one or more peroxides may comprise at least one of hydrogen peroxide and peracetic acid, or a

mixture of hydrogen peroxide and peracetic acid. These peroxides represent the most effective peroxide sterilants which may all advantageously be stabilised in the container.
[0009] The peroxide may be present in the composition in an amount of 0.01 wt % or higher, from 0.01 to 4.5 wt % or 0.1 to 4.5 wt %, or 0.5 to 4.0 wt %, or 1.0 to 3.0 wt %. This range represents the most effective and safe peroxide concentration range for a ready-to-use sterilant.
[0010] The container may comprise aluminium or an aluminium alloy. Aluminium is a preferred material for the container due to its low weight and structural rigidity. Although aluminium can react with peroxide, the PAM coating provides a barrier which prevents contact between the aluminium and peroxide.
[0011] The container may be impervious to light. By preventing light from entering the interior of the container, UV-induced degradation of the peroxide can be reduced, and the shelf life of the composition extended.
[0012] The container may contain a propellant. Preferably the propellant may be selected from one or more of nitrogen, dimethyl ether (DME), propane, n-butane, and iso-butane. The propellant may act as a blowing agent to form the foam when the composition is released from the container.
[0013] The container may be obtainable (e.g. formed) by extrusion of a billet of aluminium or aluminium alloy. The use of extrusion to form the container advantageously provides a smooth inner surface on the container walls and avoids the presence of imperfections or mould seams which can result from other manufacturing processes. This minimises the likelihood of perforations in the PAM coating, which could result in the peroxide coming into contact with the aluminium of the container wall and decomposing.
[0014] The aluminium alloy may comprise one or more of copper, magnesium, silicon, manganese, tin and zinc. The use of these metals in the alloy may provide advantageous properties such as enhanced strength, good weldability and/or corrosion resistance.
[0015] The PAM coating may have a thickness of from 0.1 μm to 5 μm. This range may provide the optimal thickness required to fully coat the interior of the container with barrier integrity while minimising production costs.
[0016] The PAM may have a number average molecular weight of from 1000 to 60,000, such as from 5,000 to 30,000, from 10,000 to 20,000, or about 15,000. PAM polymers within these ranges may provide an optimal stabilising effect on the peroxide. Number average molecular weight can be measured using a Waters Gel Permeation Chromatography device using a mixed media column with THE eluent at a flow rate of 0.9 ml/min by reference to polystyrene standards, as explained in WO2014096075A1.
[0017] The coating may be applied by spray coating and/or spin spray coating. These methods may advantageously be suitable for providing a complete coating of the container inner wall and/or provide a uniform coating thickness.
[0018] The container may be sealed with a valve. It can be helpful to provide a valve in which valve surfaces facing into the container do not contain metal or are coated with a polyamide-imide (PAM) coating. Peroxide containers are typically stored standing upright, e.g. as a cylinder standing on one end, with fluid exit points such as valves positioned at the top of the container. As such, valves do not routinely contact peroxide-containing fluids because there is a headspace separating the peroxide from the valve. However, in applications where the container is stored for long periods, there can be occasional contact with the valve if the container is knocked over, shaken during transport and so on, which gradually reduces peroxide concentration. This can be particularly important if the peroxide is to be used as a sterilant following prolonged storage, where concentration can be crucial to satisfactory sterilisation.
[0019] The foam-forming aqueous composition may further comprise one or more components selected from the group consisting of lipids, carbohydrates, proteins, surfactants and natural adjuvants. These components may produce the foam when ejected from the container.
[0020] The foam may be suitable for application to a surface having a dyne level of 20 to 60

dynes/cm. The foam may reduce the dyne level of the surface by 5% to 95%, such as from 20 to 80%, from 25% to 75%, from 30 to 70%, from 40% to 60% or by 50%. Advantageously, by decreasing the dyne level of the surface, the foam may reduce the ability of contaminants to adhere to the surface. Preferably the surface is a surface of a water pipe or drain, in which case the foam may assist in unblocking and/or preventing blockages of the pipe or drain.

[0021] In accordance with a second aspect of this invention, there is provided a use of a pressurised container containing a foam-forming aqueous composition comprising one or more peroxides for sterilising a substrate, wherein an internal surface of the container is coated with a polyamide-imide (PAM) coating.

[0022] The sterilising may comprise environmental disinfection of the substrate. Advantageously, the foam-forming aqueous composition comprising one or more peroxides may be suitable for disinfecting a large area such that the environment of the area is entirely or almost entirely disinfected. The substrate may be present in a water pipe, a plumbing system, a drain, a water circulation system, or an irrigation system.

[0023] The sterilizing may comprise spraying the foam-forming aqueous composition on the substrate. The sterilising may comprise removing biofilms, spores, such as bacterial spores, and anti-microbial resistant bacteria and viruses from the surface. The efficacy of the composition is preferably such that it has biocidal activity against difficult to kill microbes and biofilms despite being stored in the container for extended periods of time.

[0024] The container may be sealed with a valve. The valve may be a one-shot (pulse) valve. This may permit the composition to be expelled from the container in a selective manner. In other embodiments, an alternative valve may be provided to permit the entire contents of the container to be ejected in a single activation.

[0025] In accordance with a third aspect of this invention, there is provided a use of a polyamide-imide (PAM) coated container to stably store an aqueous composition comprising one or more peroxides.

[0026] In accordance with a fourth aspect of this invention, there is provided a use of a polyamide-imide (PAM) coated container containing a pressurised foam-forming aqueous composition comprising one or more peroxides for unblocking a water pipe or drain.

[0027] In accordance with a fifth aspect of this invention, there is provided a method for stabilising a foam-forming aqueous composition comprising one or more peroxides in a container, wherein the method comprises storing the composition in a container comprising a polyamide-imide (PAM) coating.

[0028] In accordance with a sixth aspect of this invention, there is provided a method for unblocking a water pipe or drain, the method comprising providing the container as defined above, and introducing the foam-forming composition into the water pipe or drain.

[0029] The advantages associated with the first aspect apply equally to the second, third, fourth, fifth and sixth aspects.

[0030] Unless otherwise stated, each of the integers described may be used in combination with any other integer as would be understood by the person skilled in the art. Further, although all aspects of the invention preferably "comprise" the features described in relation to that aspect, it is specifically envisaged that they may "consist" or "consist essentially" of those features outlined in the claims. In addition, all terms, unless specifically defined herein, are intended to be given their commonly understood meaning in the art.

[0031] As used herein and in the accompanying claims, unless the context requires otherwise, "comprise" or variations such as "comprises" or "comprising" will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

[0032] The term "consist(s)/(ing) essentially of", with respect to the components of a composition, alloy or mixture, means the composition, alloy or mixture contains the indicated components and

may contain minor additional components in an amount less than 1 wt % based on the total weight of the composition, alloy or mixture, and provided that the additional components do not substantially alter the reactivity of the composition, alloy or mixture.
[0033] The term “obtainable by” indicates an object/product that can be obtained by a stated process, but that can also be obtained by different processes if the product would possess the hallmark features of the stated process. The reader will also appreciate that the disclosure of an object/product “obtainable by” a stated process in this document can also be optionally narrowed to just being obtained (formed) by the stated process.
[0034] The term “water pipe” as used herein will be understood to refer to any pipe through which water travels or is conveyed and includes the pipes of a plumbing system, a drain, a water circulation system, an irrigation system, an engine cooling system, and the like.
[0035] Further, in the discussion of the invention, unless stated to the contrary, the disclosure of alternative values for the upper or lower limit of the permitted range of a parameter is to be construed as an implied statement that each intermediate value of the said parameter, lying between the smaller and greater of the alternatives, is itself also disclosed as a possible value for the parameter.
[0036] In addition, unless otherwise stated, all numerical values appearing in this application are to be understood as being modified by the term “about”. As used herein, the term “about” means that the stated value can vary by ±10%. For example, about 90 wt % means 90±9 wt %, and about 0.1 wt % means 0.1±0.01 wt %. When used with reference to a range, the term “about” applies to all values in the range.
[0037] In order that the invention may be more readily understood, it will be described further with reference to the figures and to the specific examples hereinafter.

Description

DETAILED DESCRIPTION OF THE INVENTION
[0038] The present disclosure provides a pressurised container containing a foam-forming aqueous composition comprising one or more peroxides, wherein an internal surface of the container is coated with a polyamide-imide (PAM) coating.
[0039] The container may be configured to expel the composition as a foam. To this end, the container may further contain a propellant which acts as a blowing agent to form the foam. The propellant may be selected from one or more of nitrogen, dimethyl ether (DME), propane, n-butane, iso-butane and pentane. In some embodiments, the propellant may comprise a combination of n-butane, isobutane and propane. The propellant may be present in the composition in an amount of from 1 wt % to 99 wt %, from 5 wt % to 80 wt %, from 10 wt % to 60 wt %, from 15 wt % to 50 wt %, from 20 wt % to 40 wt %, from 20 wt % to 30 wt %, or about 25 wt %. Preferably the propellant is present in an amount of from 20 wt % to 40 wt %, or about 25 wt %.
[0040] The container may comprise aluminium or an aluminium alloy. The aluminium alloy may comprise one or more of copper, magnesium, silicon, manganese, tin and zinc. The use of these metals in the alloy may provide advantageous properties such as enhanced strength, good weldability and/or corrosion resistance. The container may be obtainable (e.g. formed) by extrusion of a billet of aluminium or aluminium alloy. This process avoids the formation of seams or point imperfections in the internal surface of the container, which may perforate the PAM coating and expose the peroxide to the container wall. If the internal surface contains seams and/or joint imperfections, it can be necessary to apply a thicker coating of PAM to ensure barrier integrity, which increases production cost.
[0041] The container may be impervious to light, particularly in embodiments in which the container comprises aluminium or aluminium alloy. It is important to ensure that UV radiation is

excluded from the interior of the container to avoid degradation of the peroxide. In some embodiments, for example where a wall of the container is light permeable, a UV impermeable coating may be applied to the wall.

[0042] In order to permit the composition to exit the container, a mouth of the container may be sealed with a valve. The valve may be a one-shot (pulse) valve. Pulse valves provide a momentary (pulsed) output at the container exit port when pressure is applied at the inlet. No additional flow is possible until pressure at the inlet is removed, reset time allowed, and pressure reapplied. This may allow selective ejection of the composition from the container. In other embodiments, a valve may be provided which permits the entire contents of the container to be ejected in a single activation. The valve may be secured to the container by methods commonly known in the art. It can be helpful to provide a valve in which valve surfaces facing into the container do not contain metal or are coated with a polyamide-imide (PAM) coating. Peroxide containers are typically stored standing upright, e.g. a cylindrical container standing on one end, with fluid exit points such as valves positioned at the top of the container. As such, valves do not routinely contact peroxide-containing fluids because there is a headspace separating the peroxide from the valve. However, in applications where the container is stored for long periods, there can be occasionally contact with the valve if the container is knocked over, shaken during transport and so on, which gradually reduces peroxide concentration. This can be particularly important if the peroxide is to be used as a sterilant following prolonged storage, where concentration can be crucial to satisfactory sterilisation.

[0043] The one or more peroxides may comprise at least one of hydrogen peroxide, peracetic acid, performic acid, peroxymonosulfuric acid, peroxynitric acid, and peroxymonophosphoric acid. For example, the one or more peroxides may comprise at least one of hydrogen peroxide and peracetic acid, or a mixture of hydrogen peroxide and peracetic acid. These peroxides represent the most effective peroxide sterilants and they may all be advantageously stabilised in the container.

[0044] The peroxide may be present in the composition in an amount of from 0.01 to 4.5 wt %. In some embodiments, the peroxide may be present in the composition in an amount of from 0.1 to 4.5 wt %, or 0.5 to 4.0 wt %, or 1.0 to 3.0 wt %.

[0045] The composition may further comprise one or more foaming agents selected from the group consisting of lipids, carbohydrates, proteins, surfactants and natural adjuvants. Preferably a combination of foaming agents is used. The surfactant may be selected from one or more of PEG-150-Distearate, didecyldimethylammonium chloride, alkyl dimethyl benzyl ammonium chloride (Zephiran®), stearic acid, sorbitol, and palmitic acid. These components may form the foam when combined with the propellant (blowing agent) and ejected from the container.

[0046] The composition may further comprise one or more adjuvants such as water, an organic acid (e.g. formic acid, acetic acid, or propionic acid), a solvent (e.g. acetonitrile, methanol, ethanol, propanol, isopropanol, butanol or isobutanol, or paraffinum liquidum), or a base (e.g. triethanolamine).

[0047] The polyamide-imide (PAM) coating may provide a strong, thermally stable, chemically resistant barrier on the internal wall of the container which may serve to stabilise the peroxide. Furthermore, the polyamide-imide coating is resistant to deformation or creep due to the strong intermolecular interactions arising from the polyimide functional groups and the ability of the polymer chains to hydrogen bond with one another through the amide bond. Advantageously, the PAM coating may provide a stabilising effect which permits the composition to be stored for extended periods of time without appreciable degradation of the one or more peroxides. The PAM may coat the entire internal surface of the container, or at least surfaces that could otherwise cause peroxide decomposition as a result of the materials forming the surface. For instance, the skilled person will appreciate that a plastic component might not need coating provided that the plastic will not degrade the peroxide. In some embodiments, the PAM coating may comprise gold pam-2-c-internal liner 8460 N. An example of a PAM coating which is suitable for use in the present

invention is described in WO2014096075A1, the contents of which is incorporated herein by reference.
[0048] The PAM coating may have a thickness of from 0.1 μm to 5 μm, from 0.5 μm to 4 μm, from 1 μm to 3 μm, from 1.5 μm to 2.5 μm or about 2 μm. This range may provide the optimal thickness required to fully coat the interior of the container while minimising production costs. This is particularly true for containers having a substantially smooth internal surface. For example, a container that can be obtained by extruding a billet will not have seams running the length of the container and will have fewer point imperfections. Both seams and point imperfections create localised steps in the surface, which make it difficult to comprehensively coat the metal surface with a thin PAM coating.
[0049] The PAM may have a number average molecular weight of from 1000 to 60,000, from 5,000 to 30,000, from 10,000 to 20,000, or about 15,000. PAM polymers within these ranges may provide an optimal stabilising effect on the peroxide.
[0050] The coating may be applied by spray coating and/or spin spray coating to provide a uniform covering of the internal container wall. However, any alternative coating method which provides a uniform layer of PAM on the internal wall may equally be used.
[0051] The foam may be suitable for application to a substrate having a dyne level of 20 to 60 dynes/cm. The dyne level is a measure of the surface energy of the substrate. It is typically determined by a dyne test, also known as the ink method. The test is based on the ASTM/ISO 9277 standard for measuring surface energy. The higher the dyne value achieved, the higher the wetting tension of the substrate. Higher wetting tensions, which approximate surface energies, are generally associated with higher rates of successful adhesion. This can affect the degree to which contaminants, such as biological pathogens, are able to adhere to substrates. By lowering the dyne of a surface, the ability of contaminants to adhere to the surface can be reduced. Therefore, biological contaminants such as bacteria, fungi, viruses, amoebae, spores, and other pathogens can be removed from a surface by reducing its dyne level. The foam may reduce the dyne level of the substrate by 1% to 99%, such as from 25% to 75%, 40% to 60% or by 50%. In some embodiments, the foam may be suitable for unblocking and/or preventing blockages of a water pipe or drain.
[0052] The substrate may be present in a water pipe of a water system, such as a plumbing system, a water reticulation system, an irrigation system, a drain system or a septic tank and associated pipework system. In use, the foam-forming composition may be sprayed onto the substrate and allowed to exert its biocidal and/or dyne lowering activity. The composition may be capable of providing environmental disinfection of the system whereby the system is entirely or almost entirely disinfected.
[0053] The invention will now be described in further detail regarding the following non-limiting examples.

EXAMPLES

Example 1

[0054] A mixing vessel was charged with deionised water to a specific, chosen w/w value. All further ingredients, optionally including an adjuvant, was added sequentially to a proprietary formula to specific w/w values, mechanically stirring at each stage. A lab sample was collected for final verification of H.sub.2O.sub.2 and Peracetic acid (PAA) content.

Example 2

[0055] An aluminum/aluminum alloy puck was placed on an automatic mandrel. An extrusion process initiated with a hydraulic ram and forming tool made contact with the pucks outer surface and stretched it over a preformed shaped mould to form an aluminum flask suitable for storing a composition of the invention. A polyamide-imide (PAM) coating was then applied to the inside of the aluminum flask by spin-coating, in accordance with the detail description section of this application.

Example 3

[0056] Samples of a composition comprising about 66 wt % water, 16 wt % DME, 0.22 wt % hydrogen peroxide, 0.05 wt % peracetic acid, and about 0.1 wt % acetic acid were prepared according to Example 1 and stored in aluminum flasks having an internal PAM coating prepared according to Example 2. The flasks were sealed with a pulse valve and stored at temperatures ranging from 5° C. to 50° C. for periods of up to 2 years.
[0057] Thereafter in an annual cycle the compositions were sprayed onto petri dishes inoculated with bacterial spores and, after a period of 10 minutes, swabs of the surfaces were taken and tested. In all cases, no detectable contamination of the surfaces was measurable indicating that the peroxide had not degraded.
[0058] Chemical concentration tests were also conducted and recorded showing no deterioration of the peroxide.
[0059] The results of the swab tests and the chemical concentrations tests are shown in the table below. The tests were performed on an annual cycle after 2 years of storage as described above. Each test was performed on 4 samples.
TABLE-US-00001 Sample Test Year 3 Year 4 Year 5 1 Spores detected 0 0 0 Peroxide >0.28 >0.28 >0.28 concentration (wt %) 2 Spores detected 0 0 0 Peroxide >0.28 >0.28 >0.28 concentration (wt %) 3 Spores detected 0 0 0 Peroxide >0.28 >0.28 >0.28 concentration (wt %) 4 Spores detected 0 0 0 Peroxide >0.28 >0.28 >0.28 concentration (wt %)
[0060] A shown in the table, there was no degradation of peroxide over time and no decrease in the efficacy of the disinfectant as evidenced by the absence of spores. These results demonstrate that the composition of the invention is stable over a long period of time.
[0061] It would be appreciated that the process and apparatus of the invention are capable of being implemented in a variety of ways, only a few of which have been illustrated and described above.
[0062] The present invention can be further understood by reference to the following clauses:
[0063] 1. A pressurised container containing a foam-forming aqueous composition comprising one or more peroxides, wherein an internal surface of the container is coated with a polyamide-imide (PAM) coating.
[0064] 2. The container according to clause 1, wherein the one or more peroxides comprises at least one of hydrogen peroxide, peracetic acid, performic acid, peroxymonosulfuric acid, peroxynitric acid, and peroxymonophosphoric acid, such as at least one of hydrogen peroxide and peracetic acid, or a mixture of hydrogen peroxide and peracetic acid.
[0065] 3. The container according to any preceding clause, wherein the peroxide is present in the composition in an amount of from 0.01 to 4.5 wt % or 0.1 to 4.5 wt %, or 0.5 to 4.0 wt %, or 1.0 to 3.0 wt %.
[0066] 4. The container according to any preceding clause, wherein a mixture of hydrogen peroxide and peracetic acid is present in the composition in an amount of from 0.01 to 4.5 wt % or 0.1 to 4.5 wt %, or 0.5 to 4.0 wt %, or 1.0 to 3.0 wt %.
[0067] 5. The container according to any of clauses 1 to 3, wherein hydrogen peroxide is present in the composition in an amount of from 0.01 to 4.5 wt % or 0.1 to 4.5 wt %, or 0.5 to 4.0 wt %, or 1.0 to 3.0 wt %.
[0068] 6. The container according to any of clauses 1 to 3, wherein peracetic acid is present in the composition in an amount of from 0.01 to 4.5 wt % or 0.1 to 4.5 wt %, or 0.5 to 4.0 wt %, or 1.0 to 3.0 wt %.
[0069] 7. The container according to any preceding clause, wherein the container comprises aluminium or an aluminium alloy.
[0070] 8. The container according to any preceding clause, wherein the container is impervious to light.
[0071] 9. The container according to any preceding clause, wherein the container contains a propellant, preferably wherein the propellant is selected from one or more of nitrogen, dimethyl ether (DME), propane, n-butane, and iso-butane.

[0072] 10. The container according to any preceding clause, wherein the container has been formed by extrusion of a billet of aluminium or aluminium alloy.
[0073] 11. The container according to clause 10, wherein the aluminium alloy comprises one or more of copper, magnesium, silicon, manganese, tin and zinc.
[0074] 12. The container according to any preceding clause, wherein the PAM coating has a thickness of from 0.1 μm to 5 μm.
[0075] 13. The container according to any preceding clause, wherein the PAM has a number average molecular weight of from 1000 to 60,000, such as from 5,000 to 30,000, from 10,000 to 20,000, or about 15,000.
[0076] 14. The container according to any preceding clause, wherein the coating is applied by spray coating and/or spin spray coating.
[0077] 15. The container according to any preceding clause, wherein the foam-forming aqueous composition further comprises one or more components selected from the group consisting of lipids, carbohydrates, proteins, surfactants and natural adjuvants.
[0078] 16. The container according to any preceding clause, wherein the foam is for application to a surface having a dyne level of 20 to 60 dynes/cm.
[0079] 17. The container according to any preceding clause, wherein the foam is a sterilising foam.
[0080] 18. The container according to any preceding clause, wherein the foam is formulated to be deposited in a water pipe or drain.
[0081] 19. The container according to any preceding clause, wherein the PAM coating has a thickness of from 0.1 μm to 5 μm and the a foam-forming aqueous composition comprises a mixture of hydrogen peroxide and peracetic acid in an amount of from 0.01 to 4.5 wt %, hydrogen peroxide in an amount of from 0.01 to 4.5 wt % or peracetic acid in an amount of from 0.01 to 4.5 wt %, optionally wherein the foam is formulated to be deposited in a water pipe or drain.
[0082] 20. The container according to any preceding claim, wherein the polyamide-imide (PAM) coating covers at least 95%, at least 99% or the whole of the internal surface forming the container.
[0083] 21. The container according to any preceding clause, wherein the container is sealed with a valve, preferably wherein the valve is a one-shot (pulse) valve, optionally wherein the valve surfaces facing into the container do not contain a metal or are coated with a polyamide-imide (PAM) coating.
[0084] 22. The container according to clause 21, wherein valve surfaces facing into the container does not contain a metal.
[0085] 20. Use of a pressurised container containing a foam-forming aqueous composition comprising one or more peroxides for sterilising a substrate, wherein an internal surface of the container is coated with a polyamide-imide (PAM) coating optionally wherein the container is as defined in any of clauses 2 to 22.
[0086] 21. The use according to clause 20, wherein the sterilising comprises environmental disinfection of the substrate.
[0087] 22. The use according to clauses 20 or 21, wherein the sterilising comprises spraying the aqueous composition on the substrate.
[0088] 23. The use according to any of clauses 20 to 23, wherein the sterilising comprises sterilising spores.
[0089] 24. The use according to any of clauses 20 to 23, wherein the container is sealed with a valve, preferably wherein the valve is a one-shot (pulse) valve.
[0090] 25. Use of a polyamide-imide (PAM) coated container to stably store a pressurised foam-forming aqueous composition comprising one or more peroxides, optionally wherein the container is as defined in any of clauses 2 to 22.
[0091] 26. Use of a polyamide-imide (PAM) coated container containing a pressurised foam-forming aqueous composition comprising one or more peroxides for unblocking a water pipe or drain, optionally wherein the container is as defined in any of clauses 2 to 22.

[0092] 27. A method for stabilising a foam-forming aqueous composition comprising one or more peroxides in a container, wherein the method comprises storing the composition in a container comprising a polyamide-imide (PAM) coating, optionally wherein the container is as defined in any of clauses 2 to 22.
[0093] 28. A method for unblocking a drain, the method comprising providing the container according to any of clauses 1 to 2 and introducing the foam-forming composition into the drain.

Claims

1. A pressurised container containing a foam-forming aqueous composition comprising one or more peroxides, wherein an internal surface of the container is coated with a polyamide-imide (PAM) coating having a thickness of from 0.1 μm to 5 μm, wherein the container is obtainable by extrusion of a billet of aluminium or aluminium alloy.
2. A container containing an aqueous composition comprising one or more peroxides, wherein an internal surface of the container is coated with a polyamide-imide (PAM), wherein the container is sealed with a valve in which valve surfaces facing into the container do not contain a metal or are coated with a polyamide-imide (PAM) coating.
3. The container according to claim 2, wherein the PAM coating has a thickness of from 0.1 μm to 5 μm.
4. The container according to claim 1, wherein the one or more peroxides comprises at least one of hydrogen peroxide, peracetic acid, performic acid, peroxymonosulfuric acid, peroxynitric acid, and peroxymonophosphoric acid.
5. The container according to claim 1, wherein the container contains a propellant.
6. The container according to claim 1, wherein the container has been formed by extrusion of a billet of aluminium or aluminium alloy.
7. The container according to claim 1, wherein the PAM coating has a thickness of from 0.1 μm to 5 μm and/or wherein the PAM has a number average molecular weight of from 1000 to 60,000.
8. The container according to claim 1, wherein the coating is applied by spray coating and/or spin spray coating.
9. The container according to claim 1, wherein: the foam-forming aqueous composition further comprises one or more components selected from the group consisting of lipids, carbohydrates, proteins, surfactants and natural adjuvants; and/or the foam is for application to a surface having a dyne level of 20 to 60 dynes/cm; and/or the foam is a sterilising foam; and/or the foam is formulated to be deposited in a water pipe or drain.
10. (canceled)
11. (canceled)
12. A method for stabilising a foam-forming aqueous composition comprising one or more peroxides in a container, wherein the method comprises storing the composition in a container comprising a polyamide-imide (PAM) coating.
13. The container according to claim 2, wherein the one or more peroxides comprises at least one of hydrogen peroxide, peracetic acid, performic acid, peroxymonosulfuric acid, peroxynitric acid, and peroxymonophosphoric acid.
14. The container according to claim 2, wherein the container contains a propellant.
15. The container according to claim 2, wherein the container has been formed by extrusion of a billet of aluminium or aluminium alloy.
16. The container according to claim 2, wherein the PAM coating has a thickness of from 0.1 μm to 5 μm and/or wherein the PAM has a number average molecular weight of from 1000 to 60,000.
17. The container according to claim 2, wherein the coating is applied by spray coating and/or spin spray coating.
18. The container according to claim 2, wherein: the foam-forming aqueous composition further

comprises one or more components selected from the group consisting of lipids, carbohydrates, proteins, surfactants and natural adjuvants; and/or the foam is for application to a surface having a dyne level of 20 to 60 dynes/cm; and/or the foam is a sterilising foam; and/or the foam is formulated to be deposited in a water pipe or drain.