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DEICER COMPOSITION

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This invention relates to a novel chemical composition and more particularly, to a composition which is suitable for melting ice on and defrosting a surface such as a windshield of a car.

The prior art has provided a number of deicer compositions, none of which has proven to be completely free from attendant disadvantages when used. Low boiling point alcohols, for example, are commonly used to deice and defrost surfaces such as automotive windshields, airplane wings, and the like. Unfortunately such alcohols are dangerously flammable, and in addition, they tend to attack any painted surface which is adjacent to the surface being deiced. This attack is particularly severe and undesirable for automotive finishes. Other deicers of the prior art, while being inert to automobile finishes, are so viscous that they smear the surface which is being deiced, and thereby in the case of an automobile windshield, reduce visibility and cause a safety hazard.

In addition, to these serious failings of the deicing compositions of the prior art, the mode and manner in which they are dispensed has left much to be desired. For obvious reasons, a preferable way of dispensing a deicing composition is from a pressurized or aerosol container. Unfortunately, the use of a liquefied gas as the propellant is limited due to the high pressures which must be employed. A common failing of prior art aerosol devices, which use a gas such as nitrogen, is caused by the fact the pressure-volume behavior of such a gas is similar to that of an ideal gas. Thus, the pressure in the aerosol container drops off rapidly as the contents are removed. In order to remove all the contents, using nitrogen as the propellant, the initial pressure would have to be excessive or the container would have to be greatly under-filled to give a large headspace. In addition, many prior art aerosols have a weak spray pattern at low temperatures due to the characteristics of the propellant which is employed.

The principal object of this invention is to provide a deicing composition which is characterized by superior deicing properties, is non-smearing, has a high flash point and is non-deleterious to automobile finishes.

A concurrent object of this invention is to provide a packaged deicing composition, complete with propellant, which has a good spray pattern at low temperatures.

The objects of the invention are accomplished by a deicing composition which comprises normal propanol and ethylene glycol and also preferably water. In the packaged embodiment, carbon dioxide is employed as the propellant. If desired, an inhibitor, such as morpholine, may be added to the composition to prevent attack of the packaging container.

In the practice of the invention, the deicing composition may suitably comprise 25 to 95 weight percent normal propanol, 5 to 50 weight percent ethylene glycol and from no percent to 25 weight percent water. The preferred formulation for the deicing composition is approximately 50 to 60 weight percent anhydrous normal propanol, approximately 25 to 35 weight percent ethylene glycol, and approximately 10 to 20 weight percent water.

The aerosol composition of the invention may be made by adding carbon dioxide propellant to the deicer composition, and preferably a small amount of inhibitor, such

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as morpholine. Preferably, the carbon dioxide propellant is added to the deicing composition in sufficient amounts to give an equilibrium pressure of about 85 to 90 pounds per square inch gauge at 70° F.

A specific example of the aerosol composition of the invention may be prepared as follows. To every 100 parts by weight of a prepared deicing composition comprising 55 weight percent anhydrous normal propanol, 30 weight percent ethylene glycol, and 15 weight percent water, 0.2 part by weight morpholine inhibitor is added. For every 100 parts by weight of this mixture, 2.25 parts by weight carbon dioxide is added, or approximately 8.5 grams carbon dioxide per 14 ounces of deicer composition plus inhibitor.

In order to more fully understand the invention, the function of each component of the compositions of the invention will be separately discussed.

Normal propanol contributes to the low viscosity and high flash point of the deicing composition of the invention. In this connection, normal propanol should be distinguished from isopropanol which, while having the same chemical formula, differs structurally from normal propanol. Prior art compositions made with isopropanol have an undesirably low flash point and a viscosity higher than normal propanol compositions. In direct contrast, the composition of the subject invention employing normal propanol has a flash point of 95° F. and accordingly is not easily ignited. In addition, normal propanol has a higher boiling point than isopropanol, hence, a lower evaporation rate. Accordingly, it will remain on the iced surfaces longer and give a more efficient penetration. It also cools the surface less due to its vaporization heat requirements.

A 50-60 percent by weight concentration of normal propanol is preferred, since this enables the composition to contain a maximum amount of ethylene glycol with an optimum product viscosity. The preferred composition has a viscosity of about 24 centistokes at 0° F. Maximum viscosity for good sprayability is about 30 centistokes at any temperature that the product may be used.

The ethylene glycol contributes chiefly to the melting of the frost and ice. Aided by the penetrating action of the normal propanol, it acts quickly. A 25-35 percent by weight concentration is preferred for high melting capacity and ease of handling.

Smearing of the defrosted or deiced surface by an ethylene glycol residue is effectively avoided if some water is contained in the composition. Experiments have shown that if the ethylene glycol-water ratio does not exceed 2:1, smearing is positively avoided. In the preferred embodiment, just enough water is added to avoid smearing on dry windshields. In normal service, however, usually enough water becomes available on the windshield when the ice and frost are melted, and none need be included in the composition.

The water also serves an additional purpose. In melting ice and frost, the deicer must draw heat from some source. If only the surface to be deiced is relied upon for heat, the surface could be sufficiently cooled to re-freeze the molten ice. However, in the preferred composition of this invention, the water contained therein serves as its own heat source. The high specific heat of water allows it to give up relatively large quantities of heat with a relatively small decrease in temperature. Thus, the water acts also as a heat reservoir during the melting process. Since the deicer composition does not freeze at temperatures down to about -70° F., it is not in danger of freezing itself during use.

Experimental work has shown that the deicer composition itself does not present a container-corrosion prob-

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lem in ferrous metal containers even with water present in the composition if the containers are lined with a suitable protective coating. Suitable liner compositions are phenolic and epoxy resins. If desired, a small amount of morpholine may be added to protect the container in case pinholes appear or the coating is damaged during fabrication. Other compounds that can be used for this purpose are morpholine phosphate and the like.

As a further aid in preventing corrosion of metal containers, water having a relatively low ion content is preferred. Distilled or deionized water is suitable for this purpose. However, if non-corrosive containers such as plastic or glass are used, tap water having a relatively high ion content can be successfully employed for the purposes of this invention. The deicing properties of the composition are not affected by the ion content of the water used.

While the deicer composition can be effectively applied to a surface by means of an atomizer, a spray nozzle or head, or even by means of a brush, in the preferred embodiment, the deicer is applied to the surface from a pressurized container.

For this purpose carbon dioxide is the preferred propellant, particularly since it is partially soluble in the deicing composition. As the headspace within the container increases due to the removal of the contents, some of the dissolved carbon dioxide will leave the solution to fill the void. This effectively dampens the pressure drop-off as the container is emptied and leaves an adequate terminal pressure to exhaust all the contents in a desirable manner.

Partial solubility of the propellant gas in the deicer composition is desirable also for another reason. As the material is sprayed, an aerosol action is achieved when the dissolved gas expands and breaks up the spray as it reaches the atmosphere.

Prior to sealing the deicer-propellant composition of the invention in a container, the container should be completely purged of air. This may suitably be accomplished by placing Dry Ice in the container before the composition is added. The container would be purged by the evolving gas and the headspace swept clean by the blanket which develops. Furthermore, if desired, an antioxidant or oxygen scavenger may be added to the composition to chemically remove any remaining oxygen.

The pressurizing of the container with carbon dioxide may be readily accomplished at the desired pressures by employing a conventional gasser-shaker device.

The deicer composition of the invention is also useful in preventing ice and frost formation. A dry windshield can be sprayed with the deicer composition prior to exposure to frosting and icing conditions. As long as some deicer is present on the windshield, frost formation will be prevented or at least retarded. This retardation effect can last from several hours up to about half a day depending on the weather, i.e., rain and strong winds will tend to accelerate the removal of the deicer composition from the windshield. However, even after the windshield becomes covered with frost and ice after prolonged exposure to inclement weather, the ice is more easily removed since the thin coating of deicer composition on the windshield prevents the ice from sticking tightly.

Specific examples illustrating the success of the composition of the invention are given below:

EXAMPLE I

Frost Removal

A completely frosted automobile windshield was kept overnight in a 0° F. atmosphere. The ambient temperature rose during the actual testing to about 5° F.

A deicer composition of this invention containing 55 weight percent normal propanol, 30 weight percent ethylene glycol, 15 weight percent water, and morpholine was

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placed in a sideseam metal can and pressurized with carbon dioxide to an equilibrium pressure of about 85 pounds per square inch gauge at 70° F. The sealed can was also stored overnight at 0° F.

The deicer composition was sprayed on the cold windshield during the experiment. An excellent spray covered the complete windshield in a few seconds, and the windshield was cleared of frost the instant it was contacted by the deicer spray.

EXAMPLE II

Ice and Frost Removal

A windshield covered with frost and ice was kept overnight in a 0° F. atmosphere. The ambient temperature rose during the actual testing about 5° F.

A deicer composition similar to that employed in Example I was used. This composition was stored in a pressurized can overnight at 0° F.

The deicer composition was sprayed on the cold windshield during the experiment. Most of the ice was removed from the windshield in about 30 seconds.

EXAMPLE III

Ice and Frost Removal

A completely frosted automobile windshield was kept overnight at 20° F.

A deicer composition of this invention containing 50 weight percent normal propanol, 35 weight percent ethylene glycol, and 15 weight percent water was placed in a sideseam metal can and pressurized with carbon dioxide to an equilibrium pressure of about 85 pounds per square inch gauge at 70° F. The sealed can was also stored overnight at 20° F.

The deicer composition was sprayed on the cold windshield during the experiment. An excellent spray covered the complete windshield in a few seconds, and the windshield was cleared of frost the instant it was contacted by the deicer spray.

The windshield was then rubbed dry and a thin layer of ice was formed on the glass. The deicer composition was again sprayed on the windshield, and in about 30 seconds most of the ice was melted from the windshield.

EXAMPLE IV

Ice and Frost Removal

The test of Example III was duplicated using a deicer composition of the invention containing 90 weight percent normal propanol and 10 weight percent ethylene glycol. Results for the frost test were identical, and complete melting of the ice was achieved in about 60 seconds.

EXAMPLE V

Maintenance of Clear Windshields

Two automobiles were exposed to city driving conditions in freezing snow-rain. The ambient temperature was about 25° F. The front and rear windows of these automobiles were cleaned and kept clear from snow and ice by the preferred deicer composition of this invention during the test. The test duration was about 1.5 hours.

We claim:

1. A deicing composition consisting essentially of 25 to 95 weight percent normal propanol, 5 to 50 weight percent ethylene glycol, and the remainder water, the water content of said composition not exceeding 25 weight percent.

2. A deicing composition consisting essentially of 50 to 60 weight percent normal propanol, 25 to 35 weight percent ethylene glycol and 10 to 20 weight percent water.

3. A deicing composition consisting essentially of approximately 55 weight percent anhydrous normal propanol, approximately 30 weight percent ethylene glycol, and approximately 15 weight percent water.

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4. In a sealed container which is provided with a spray valve, a deicing composition which consists essentially of an active portion comprising 25 to 95 weight percent normal propanol, 5 to 50 weight percent ethylene glycol, up to 25 weight percent water and a propellant portion of carbon dioxide.

5. In a sealed container which is provided with a spray valve, the deicing composition of claim 4 which contains an inhibitor portion.

6. In a sealed container which is provided with a spray valve, the deicing composition of claim 5 wherein a sufficient amount of carbon dioxide propellant is present with said active portion and said inhibitor portion to give an equilibrium pressure in the range of from about 85 to 90 pounds per square inch gauge at 70° F.

7. In a sealed container which is provided with a spray valve, a deicing composition which consists essentially of an active portion comprising 55 weight percent normal propanol, 30 weight percent ethylene glycol, and 15 weight percent water, an inhibitor portion of morpholine, and a propellant portion of carbon dioxide,

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said inhibitor portion being present in about 0.2 part by weight to every 100 parts by weight of said active portion and about 2.25 parts by weight of propellant to every 100 parts by weight of said active portion plus inhibitor portion.

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