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PROCESS AND COMPOSITION FOR BRIGHTENING THE SKIN OF AIRCRAFT

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The surfaces of aircraft or the skin of the fuselage, wings and control which are aluminum or aluminum alloy members in operation become quite dull in appearance. This is particularly true in the case of jet aircraft and there has been used a process for brightening these skins. This process employed a mixture of hydrofluoric acid and fluosilicic acid. This treating material is quite unsatisfactory for the purpose in that it tends to run off and streak the surfaces. Moreover, the skins of aluminum alloy surfaces seem to be to an extent porous so that the treating material is capable of penetrating interiorly where some thereof is not removed and causes subsequent interior corrosion.

It is a general object of the present invention to provide a composition and process for brightening the skin of aircraft which has the advantage that the materials employed will not flow and streak the skins during treatment, and has the further advantage that the material does not penetrate the skins but confines its action to the surface thereof so that the brightening of the skins can be effected without danger of subsequent interior corrosion of the skin.

Essentially the composition of the present invention and the process of the present invention embodies the use of a viscous composition which may be applied to the skin of aircraft for etching the skin of the aircraft and while this composition is designed to be less corrosive to the skins than those previously employed are at the same time equally effective in brightening the skins.

I have discovered that polystyrene sulfonic acids have the property of rendering the composition more viscous and less penetrative and therefore have the property of confining the action of the composition to the surface eliminating any substantial corrosion of the surface to be brightened. The acidic elements of the composition of the present invention are provided by combining hydrofluoric acid or hydrofluoric acid compounds with a polystyrene sulfonic acid, and preferably also an aryl sulfonic acid. The sulfonic acids, i. e., both the polystyrene sulfonic acid and the aryl sulfonic acid are thought, in the composition, to hydrolize to some extent to free sulfuric acid at the surface to be brightened, producing an effective brightening of the skin of the aircraft even though the composition is much less acidic than those previously employed, while at the same time the composition is rendered sufficiently viscous by the polystyrene sulfonic

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acids so that it does not flow or streak over the surface.

As a further means of obtaining brightening of the aluminum alloy skins with less corrosive acids, I include in the composition a sequestering agent, that is a material which has the property of maintaining in solution any aluminum compounds or complexes formed in the treatment without which the less active acids of the composition of the present invention would be relatively ineffective in the desired skin brightening operation.

Thus in the composition of the present invention I utilize, in combination with hydrofluoric acid or ammonia acid fluoride, a liberating compound of both polystyrene sulfonic acid and an aryl sulfonic acid, together with a sequestering agent. The polystyrene sulfonic acid may be obtained either by first sulfonating the styrene and then polymerizing the same, which is the preferred method, or by first polymerizing styrene and then sulfonating the same. The latter process has a disadvantage that it interferes to some extent with the control or degree of polymerization and the degree of polymerization or the molecular weight of the polystyrene sulfonic acid is a factor which controls the viscosity of the material employed.

I have found it desirable to employ polystyrene sulfonic acids with a molecular weight within the range of 20,000 to 250,000. The aryl sulfonic acids employed should be selected from those containing less than 4 alkyl carbon atoms, including for example, benzene sulfonic acid, toluene sulfonic acid and xylene sulfonic acid. The sequestering agent may be any water soluble aliphatic hydroxy carboxylic acid, or any ammonia or sodium salts thereof which in the composition yields essentially the acids. Some of the suitable sequestering agents are citric acid, tartaric acid, gluconic acid, or glucono delta lactone. Ammonia salts are in some cases superior to the acids themselves as ammonia with the acids assist the sequestering action.

The composition and process for brightening the skins of aircraft of the present invention, together with further objects and advantages of the invention will be more fully understood from the following description of a preferred example of the invention.

The preferred example of the invention is given in connection with a composition suitable for delivery which is intended to be used, however, by subsequent dilution with about 1 to 2

parts of water. A preferred composition comprises:

	Per cent
Polystyrene sulfonic acid.....	6
Citric acid.....	5
Ammonia acid fluoride ($\text{NH}_4\text{H.F.}^\text{F}$).....	3
Benzene sulfonic acid.....	10
Phosphoric acid.....	10
Water.....	Balance

The polystyrene sulfonic acids may vary from 3 to 13% in a composition which is to be diluted with 1 to 2 parts of water but as applied after dilution it should be between 1% and 6½%. The citric acid of the composition is but one example of a suitable sequestering agent which may be any water soluble aliphatic hydroxy carboxylic acid which, for example in addition to citric acid, may include tartaric acid, gluconic acid, glucono delta lactone, or the sodium or ammonia salts thereof, and the proportion of the water soluble aliphatic hydroxy carboxylic acid in the composition for dilution may vary from 2% to 6%, or in the composition as applied may vary from ⅓% to 3%. The ammonia acid fluoride of the compound is but a convenient form for adding fluorine acid and fluorine acid itself may be employed in lieu thereof, and in the concentrated solution the ammonia acid fluoride, hydrofluoric acid liberating material varies from 1% to 6%, or in the composition as applied to the skin may vary from ⅓% to 3%. The employment of ammonia acid fluoride is preferred not only because it is less dangerous to handle than hydrofluoric acid but also the ammonia content thereof in connection with the water soluble aliphatic hydroxy carboxylic acid improves the sequestering properties of the composition.

The phosphoric acid employed may in the composition before dilution vary from 2% to 20%, or may vary from ⅓% to 10% as applied to the skins of aircraft. The aryl sulfonic acid employed should be one containing less than 4 alkyl carbon atoms, such for example, as benzene sulfonic acid, toluene sulfonic acid, or xylene sulfonic acid, and the aryl sulfonic acid may vary from 2% to 20% in the material before dilution, or from ⅓% to 10% in the solution as applied. The only essential remaining element of the composition is water, although various minor percentages of impurities may be present.

By the employment of the composition of the present invention on the skins of aircraft, i. e., the aluminum or aluminum alloy surfaces thereof, it is possible to brighten such surfaces without the composition tending to run off the surface and thereby streak the same, and furthermore, the composition has been found to substantially reduce the danger of any subsequent corrosion of the brightened skins.

While the particular example of the invention herein described is well adapted to carry out the objects of the present invention, this invention is of the scope set forth in the appended claims.

I claim:

1. A composition for brightening the aluminum or aluminum alloy skin of aircraft which composition consists essentially of water, polystyrene sulfonic acid, a sequestering agent, hydrofluoric

acid material, phosphoric acid and an aryl sulfonic acid, the aryl sulfonic acid having less than 4 alkyl carbon atoms, and the sequestering agent comprising a water soluble aliphatic hydroxy carboxylic acid.

2. A composition for brightening the aluminum or aluminum alloy skin of aircraft which composition consists essentially of water, polystyrene sulfonic acid, a sequestering agent, hydrofluoric acid material, phosphoric acid, and an aryl sulfonic acid, the aryl sulfonic acid having less than 4 alkyl carbon atoms, the sequestering agent comprising a water soluble aliphatic hydroxy carboxylic acid, the polystyrene sulfonic acid being in the proportion of 1% to 13%, the sequestering agent being from ⅓% to 6%, the hydrofluoric acid being from ⅓% to 6%, the phosphoric acid being from ⅓% to 20%, and the aryl sulfonic acid being from ⅓% to 20%.

3. A composition for brightening the aluminum or aluminum alloy skin of aircraft which composition consists essentially of water, polystyrene sulfonic acid, a sequestering agent, hydrofluoric acid material, phosphoric acid and an aryl sulfonic acid, the aryl sulfonic acid having less than 4 alkyl carbon atoms, the sequestering agent comprising a water soluble aliphatic hydroxy carboxylic acid, the hydrofluoric acid employed being ammonia acid fluoride.

4. A process of brightening the aluminum or aluminum alloy skins of aircraft which comprises, treating the skins of aircraft with an aqueous solution containing essentially polystyrene sulfonic acid, a sequestering agent, hydrofluoric acid, phosphoric acid, and an aryl sulfonic acid, the sequestering agent comprising a water soluble aliphatic hydroxy carboxylic acid, and the aryl sulfonic acid containing less than 4 alkyl carbon atoms.

5. A process of brightening the aluminum or aluminum alloy skins of aircraft which comprises, treating the skins of aircraft with an aqueous solution containing essentially polystyrene sulfonic acid, a sequestering agent, hydrofluoric acid, phosphoric acid, and an aryl sulfonic acid, the sequestering agent comprising a water soluble aliphatic hydroxy carboxylic acid, and the aryl sulfonic acid containing less than 4 alkyl carbon atoms, the polystyrene sulfonic acid being present in the proportion of 1% to 6½%, the sequestering agent being present in the proportion of ⅓% to 3%, the hydrofluoric acid material being present in the proportion of ⅓% to 3%, the phosphoric acid being present in the proportion of 2% to 10%, and the aryl sulfonic acid being present in the proportion of ⅓% to 10%.

6. A process of brightening the aluminum or aluminum alloy skins of aircraft which comprises, treating the skins of aircraft with an aqueous solution containing essentially polystyrene sulfonic acid, a sequestering agent, hydrofluoric acid, phosphoric acid, and an aryl sulfonic acid, the sequestering agent comprising a water soluble aliphatic hydroxy carboxylic acid, and the aryl sulfonic acid containing less than 4 alkyl carbon atoms, the hydrofluoric acid material being ammonia acid fluoride.

No references cited.