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BRIGHTENING BATH

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This invention relates to chemical dipping processes and is particularly directed to dipping processes for brightening the surface of aluminum and/or aluminum alloys.

It is, therefore, a primary object of the invention to provide a chemical brightening bath for use in connection with aluminum and/or aluminum alloys wherein the surface of aluminum treated therein is materially brightened.

A further object of the invention is to provide a chemical brightening bath having as essential ingredients; nitric acid, ammonium bifluoride, ethylene glycol or cane sugar, chromic acid and small quantities of a soluble metal salt.

Another object of the invention is to provide a chemical brightening bath for use in connection with aluminum and/or aluminum alloys which has substantial brightening effects when using very low concentrations of the chemicals therein, said bath being of a substantially watery consistency that minimizes drag-out loss and which facilitates rinsing.

Further objects will be apparent from the following description.

The use of nitric acid-hydrofluoric acid baths for brightening aluminum and/or aluminum alloys is well known in the art, such baths create numerous industrial hazards and problems through the use of the hydrofluoric acid per se. On the other hand, nitric acid-hydrofluoric acid baths, due to the strong conjoint action of the specific acids, may be used in quite dilute condition which minimizes other production problems, for example, drag-out loss and likewise makes the rinsing of the brightened articles a relatively easy matter as compared with the usual syrupy phosphoric acid type of brightening baths.

Due to the strength of a nitric acid-hydrofluoric acid combination and the ability to use such a combination in low concentrations, the cost of the bath is reduced, making a bath of this type very desirable commercially.

We have found that reduced hazards and improved results can be obtained in baths of this character through the elimination of the hydrofluoric acid per se and by the substitution thereof of a soluble acid fluoride salt or fluoride salt. In this connection, ammonium fluoride (NH_4F) yields improved results while ammonium bifluoride (NH_4HF_2) yields exceptionally good results. To this combination may be added chromic acid and a suitable salt of a metal below hydrogen in the electro chemical series, such as copper nitrate, copper fluoride, etc., silver or gold salts, etc., plus a brightener such as ethylene glycol. These in-

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gredients may be contained in a stainless steel tank and will have excellent brightening action on aluminum and/or aluminum alloys. In fact, the action will be greatly improved over a bath utilizing nitric acid and hydrofluoric acid per se. Furthermore, we have found that the use of ammonium bifluoride extends the life of the bath in addition to yielding improved results from a brightening standpoint. In all cases, the ammonium salt of the hydrofluoric acid either as a fluoride or bifluoride gives improved results over the use of hydrofluoric acid per se even when the hydrofluoric acid is combined with other ingredients to form a salt in situ within the solution. In this connection, the improved result is probably due to the fact that the addition of ammonium fluoride or ammonium bifluoride to the bath yields the ammonium salt of the hydrofluoric acid in complete combination with no free hydrofluoric acid nor free ammonium hydroxide or other combining reagent present. If hydrofluoric acid per se is added to the bath, its combining action with other ingredients to yield salts is never complete unless definite molar quantities of all ingredients are added to assure complete reaction. Obviously, this is impossible in a commercial operation and therefore there is always an excess of the hydrofluoric acid or an excess of the combining ingredient used to make the salt. In either case, the action of the bath is deleteriously influenced. Furthermore, the NH_4HF_2 yields the most active ingredient for brightening since the salt is of an acid character without having the excessively extreme corrosive action of the acid per se.

Specifically, a formula for a bath may include:

	Range	Preferred
	Percent	Percent
Commercial nitric acid (70%)	2.0 - 7.5	3.75
Ammonium bifluoride	.30 - .75	.65
Ethylene glycol	.40 - 1.0	.60
Chromic acid (CrO_3)	.30 - .75	.65
Soluble metallic salt (copper nitrate)	.002 - .05	.0025
Water	Remainder	Remainder

This bath may be modified by using cane sugar dissolved in the bath in place of ethylene glycol within the range of .20% to 1.0% with a .30% preferred and similarly ammonium fluoride may be used in place of ammonium bifluoride within the same ranges. The bath is made up with water as a base and is operated at an elevated temperature, for example, in the order of 185° F. to 212° F. The aluminum parts to be brightened are cleaned so as to be free from grease and are

then immersed in the hot brightening bath for a period ranging from 3 to 5 minutes depending upon the finish desired, after which they are removed from the bath and thoroughly rinsed in water to remove many traces of the bath therefrom. They may then be dried by preferably dipping in hot water, followed by an air dry with or without air blast.

We have found that a brightening bath of the character described herein has good life and that the drag-out loss, due to the low viscosity of the watery solution, is maintained at a minimum. In order to keep the bath at an operating level, we add additional ingredients periodically during use as needed (this may be determined by the brightness of the parts being treated or by analysis of bath concentrations) in the following concentrations: for each square foot of surface brightened we add in the order of 3.5 cc. nitric acid, .75 gram of ammonium bifuoride and .75 cc. of ethylene glycol or .4 gram of sugar. Water may be added simultaneously to maintain the level of the bath to a given point within the brightening tank.

It is to be pointed out here that our improvements over prior art type of brighteners are directed to the use of ammonium fluoride and particularly to the use of ammonium bifuoride together with the addition of ethylene glycol or sugar as a brightener. These improvements yield a better brightening solution for the following reasons:

1. The brightening action of the bath is better;
2. The control of the bath is more easily maintained;
3. The commercial hazards of the bath are minimized; and
4. The cost of the bath is reduced.

While the embodiments of the present invention as herein disclosed, constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A brightening bath for use in connection with aluminum and/or aluminum alloys wherein the brightening is carried out at a temperature varying between 185° F. to 212° F. consisting of; a solution having as its basic ingredients ammonium bifuoride .30% to .75%, nitric acid 2.0% to 7.5%, chromic acid .30% to .75% and ethylene glycol .40% to 1.0% and wherein water makes up substantially the remainder of the bath.

2. A bath as claimed in claim 1 with the added ingredient of a salt of a metal below hydrogen in the electro-chemical series, .002% to .05%

3. A brightening bath for use in connection with aluminum and/or aluminum alloys where-

in the brightening is carried out at a temperature varying between 185° F. to 212° F. consisting of; a solution having as its basic ingredients ammonium bifuoride .65%, nitric acid 3.75%, chromic acid .65% and ethylene glycol .60% together with water which makes up substantially the remainder of the bath.

4. A brightening bath for use in connection with aluminum and/or aluminum alloys wherein the brightening is carried out at a temperature varying between 185° F. to 212° F. for a period ranging from 3 to 5 minutes, consisting of; an aqueous solution having as its basic ingredients ammonium bifuoride .65%, nitric acid 3.75%, chromic acid .65%, ethylene glycol .60% together with traces of copper nitrate.

5. A brightening bath for use in connection with aluminum and/or aluminum alloys wherein the brightening is carried out at a temperature varying between 185° F. to 212° F. consisting of; a solution having as its basic ingredients ammonium bifuoride .30% to .75%, nitric acid 2.0% to 7.5%, chromic acid .30% to .75% and cane sugar .20% to 1.0% and wherein water makes up substantially the remainder of the bath.

6. A brightening bath for use in connection with aluminum and/or aluminum alloys wherein the brightening is carried out at a temperature varying between 185° F. to 212° F. consisting of; a solution having as its basic ingredients ammonium bifuoride .65%, nitric acid 3.75%, chromic acid .65% and cane sugar .30% together with water which makes up substantially the remainder of the bath.

7. A brightening bath for use in connection with aluminum and/or aluminum alloys wherein the brightening is carried out at a temperature varying between 185° F. to 212° F. for a period ranging from 3 to 5 minutes, consisting of; an aqueous solution having as its basic ingredients ammonium bifuoride .65%, nitric acid 3.75%, chromic acid .65%, cane sugar .30%, together with traces of copper nitrate.

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