United States Patent [19]

Wells

[11] **3,793,159**

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[54] **ELECTROPLATING PLASTICS**

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[52] **U.S. Cl.** ..... **204/30,** 117/47 A, 204/20

[51] **Int. Cl.** **C23b 5/60,** B44d 1/092

[58] **Field of Search** ..... 204/20, 30; 117/47 A

[56] **References Cited**

UNITED STATES PATENTS

3,579,365	5/1971	Grunwald	106/265
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Primary Examiner—T. Tufariello

[57] **ABSTRACT**

In an electroless process for electroplating plastics containing a siliceous filler, a wash solution containing a nonionic surfactant is employed to remove the chromium from the plastic subsequent to the acid chromate etch and before electroplating.

7 Claims, No Drawings

ELECTROPLATING PLASTICS

This invention relates to the electroplating of plastics.

In one of its more specific aspects, this invention relates to an improvement in a process for electroplating plastics containing a siliceous filler in which the plastic is conditioned and plated in an electroless process.

The electroplating of plastics is well known. One such process is that described in U.S. Pat. No. 3,567,594 to Wells, the disclosure of which is incorporated herein by reference.

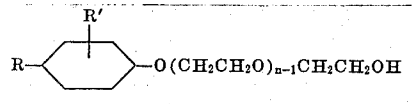
The method of the present invention is an improvement of that process and is applicable to the plastics, and can be carried out employing the conditions, the procedural steps and the reagents defined therein.

In one aspect of that process, the mineral-filled plastic is conditioned by employing an acid chromate etch and an HF treatment, the sequence of the steps not being critical. Thereafter, the plastic is water rinsed or acid rinsed and is then contacted with one or more sensitizing solutions and activating solutions, these frequently including stannous chloride and palladium ammonium chloride solutions, respectively, whose purpose is to "seed" the plastic surface. Thereafter, the plastic is contacted with one or more plating solutions.

The method of this invention relates to the water rinse or acid rinse referred to above. Since, as has been said, the acid chromate and the Hf treatment are sequentially interchangeable, it will be assumed for the purpose of this disclosure that the HF treatment is employed subsequent to the acid chromate etch without intending to limit the invention thereto.

One purpose of the invention is to facilitate complete coverage of the treated plastic surface by the subsequently applied metal. Difficulty is sometimes experienced in obtaining a continuous metal coating of the plastic substrate due to skipping or random incomplete coverage of the metal layer for reasons not clearly understood.

In general, any nonionic surfactant can be employed. Preferably, the surfactant will be an alkylphenoxypoly(ethyleneoxy)ethanol of the general formula



in which R is an alkyl radical containing eight to 12 carbon atoms exemplified by octyl, nonyl, and dodecyl radicals and R' is hydrogen or R, and *n* has a value ranging from about 2 to 30, thus the number of repeating ethylene oxide units ranges from 1 to 29.

Among those compounds which can be employed are octylphenoxypoly(ethyleneoxy)ethanol, nonylphenoxypoly(ethyleneoxy)ethanol, dodecylphenoxypoly(ethyleneoxy)ethanol, and 2,4-dioctylphenoxypoly(ethyleneoxy)ethanol.

Among the preferred surfactants is nonylphenoxypoly(ethyleneoxy)ethanol in which *n* ranges from about 9 to 10, available commercially as Igepal CO-630 from General Aniline and Film Corp.

The method of this invention can be employed by using either an aqueous solution wash followed by an acid solution wash in which either or both solutions

comprises the surfactant, or by using a single aqueous solution comprising an acid and the surfactant. The surfactant is effective in improving the process regardless of whether it is employed in conjunction with an acid wash. However, it is preferred that the acid bath be employed since the use of a bath containing an acid similar to that contained in the activator solution to which the plastic is subsequently subjected reduces dilution of the latter. Accordingly, no water rinse is employed after the acid bath containing the surfactant, the plastic being introduced from the acid bath directly into the activator.

The surfactant is effective when employed in amounts of a minimum of about 5 parts per million by volume, and greater, preferably in amounts between about 8 and about 150 ppm. The plastic is maintained in contact with the solution containing the surfactant for a period sufficient to insure complete contact, this period being that generally employed in similar rinsing operations.

The method of this invention is illustrated by the following data in which molded plastic plastes comprising mineral-filled polypropylene, previously identically processed, were introduced into various aqueous solutions as defined below. A nonionic surfactant was employed, this surfactant being nonylphenoxypoly(ethyleneoxy)ethanol in which *n* is a nominal 9 to 10. The rinsed plates were plated with several layers of metal as described in the aforementioned patent under substantially identical conditions with the following results:

Concentration in Aqeuous Solution		Electroplating Results	
HCl, Vol. %	Surfactant & Conc., ppm	% Surface Plated	Metal Adhesion, lb./in.
0	0	Less than 1	Not determined
25	0	40	Not determined
25	8.5	100	10
25	17	100	6.5
0	8.5	100	6
0	17	100	6.5

These data indicate the operability of the surfactants defined in the method of this invention in aqueous solution with or without the presence of the mineral acid, in the concentrations defined.

It will be evident from the foregoing that various modifications can be made to the method of this invention. Such are considered, however, to be within the scope thereof.

What is claimed is:

1. A method of electroplating a plastic surface which comprises:

a. preparing said plastic surface by contacting said surface with an acid chromate etching solution and a hydrogen fluoride treatment;

b. rinsing the contacted surface with an aqueous solution comprising a nonionic surfactant and hydrogen chloride;

c. then sensitizing the rinsed surface with a solution comprising stannous chloride and palladium chloride; and,

d. electroplating the sensitized surface.

2. The method of claim **1** in which said contacted surface is rinsed in an aqueous solution consisting essen-

tially of hydrochloric acid and a mono-dialkyl substituted phenoxypoly(ethyleneoxy)ethanol.

3. The method of claim 1 in which said surfactant is mono-dialkyl substituted phenoxypoly(ethyleneoxy)ethanol in which the alkyl radical contains from eight to 12 carbon atoms and the number of units of ethylene oxide in said surfactant is within the range of from about 1 to 29.

4. The method of claim 1 in which said surfactant is nonylphenoxypoly(ethyleneoxy)ethanol containing about 8 to 9 repeating units of ethylene oxide.

5. The method of claim 1 in which said surfactant is contained in said aqueous solution in an amount of at least about 5 parts by volume per million parts by volume of said solution.

6. The method of claim 5 in which said surfactant is contained in said aqueous solution in an amount within the range of from about 8 to about 150 parts by volume per million parts by volume of said solution.

7. The method of claim 1 in which said solution contains hydrochloric acid in an amount of about 25 percent by volume.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,793,159 Dated: February 19, 1974

Johnny L. Wells

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 8, after "to" insert --- about ---.

Signed and sealed this 9th day of July 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents