METHOD OF TFELOH COATING OF METALS


This invention relates to the coating of metal surfaces with polytetrafluoroethylene, commonly known by the Du Pont Company trademark "Teflon" by which name it will be hereinafter referred to.

More particularly the invention is related to the Teflon-coating of aluminum blanks to be formed into cooking utensils such as fry pans, griddles, roasters, sauce pans, cookie sheets, and the like, and a primary object is to provide an improved method of preparing the metal for the application of transparent Teflon coatings not only to insure good adhesion of the coating but also to impart an improved appearance to the finished utensil, the appearance being characterized by a bright and unusually light coloration.

Particular features of the method are the use of an iron grit for blasting the surface of the metal and increasing the surface area per square inch of the blank, a deoxidization cleaning step prior to coating, and the use of a nearly transparent, colorless Teflon.

The steps of the improved process and the objects and advantages thereof will appear from the following detailed description.

In this process the preparatory and coating operations are preferably, though not necessarily, accomplished on flat aluminum blanks after which the coated blanks are formed into the desired shape for the finished article. The steps are in the following sequence.

Two-stage power-spray wash and rinse
The first wash is in a two stage spray washer, which removes all dirt and oils which might otherwise contaminate the grit supply of the blasting operation which is to follow. It has been found that a power-spray two-stage wash coupled with a second step of clean rinsing by a fresh hot water hosing insures good adhesion of the Teflon coating and will prevent resistance to blistering during use of the articles for cooking purposes.

The first power spray is preferably with a standard mild alkaline cleaner solution, the spray nozzles being directed at the blanks at high velocity. A specific example of a commercially available mild alkaline spray concentrate is Wyandotte Company's "Spray Altrex" used in 160—180° F. hot water. For the second stage, recirculated hot water is sprayed at high velocity in similar fashion at the face of the blanks, a constant make-up and overflow being provided to reduce excessive contamination by cleaner.

Clean rinse and dry
Immediately following the second power spray a fresh hot water supply is directed by hose nozzles to complete a final rinsing and the blanks are then air dried.

Other types of conventional washing and rinsing methods such as liquid solvent degreasing, vapor degreasing, or alkaline cleaner soaks have not been found to be dependable in imparting complete resistance to blistering when the other steps of the process are followed and accordingly the mild alkaline cleaner power spray wash as above described is preferred.

Grit blast
The aluminum blanks after drying to eliminate uneven marking are next subjected to a grit blasting treatment. A standard commercial centrifugal thrower type of blasting machine is preferably used such as the "Rotoblast" Machine with rotating table as sold by the Pangborn Company. An angular grit of iron having hard, sharp edges is used. As is well known in the trade, this type of grit is made by crushing pieces of iron "shot" to impart hard, sharp angled surfaces. Conventionally it is used for preparing surfaces for galvanizing and like processes.

As is also well known, angular grit comes in different standard size classifications and it has been found that a grit on the order of SAE size classification #80 gives a roughened surface for excellent adhesion of the Teflon coating and without creating problems in obtaining a smooth outer surface of the Teflon coating. A larger size grit such as SAE #50 marks the surface to a greater degree and control of the coating to insure a smooth Teflon surface is difficult, while a smaller grit such as SAE #120 results in substantially less tenacious adhesion of the coating.

During grit blasting the supply of fresh grit must be regulated to maintain a level of 70—80% hard, sharp particles. To accomplish this, a standard air separator device may be used to remove smaller pieces of worn particles. Fresh grit is fed automatically into the machine supply to maintain the above percentage more or less constant.

As the blanks pass from the machine an air blast is then directed against them so as to remove most of the loose grit adhering to the blanks.

Second wash and clean rinse
After the air blast the blanks are next passed through a second mild alkaline cleaner power spray treatment and rinse which is identical with the initial treatment outlined by the steps prior to grit blast. The blanks are thus cleaned and loose grit adhering to the blanks is further loosened.

Deoxidization cleaning
As the blanks come from the second clean rinse some residual grit is still adhering to the surfaces. Such residual grit on the blanks at this stage causes them to be characterized by a greyish appearance. The deoxidization cleaning step next undertaken materially lightens and brightens the coloration of the aluminum surfaces.

The blanks are preferably soaked for a period of approximately eight minutes or more in a suitable aluminum deoxidizer solution such as the commercially available Wyandotte Company Cleaner #2487, the solution being made up by 14—18 oz. deoxidization cleaner per gallon of water at room temperature. The deoxidizer contains acid sulfates, chromic acid, and other additive agents. After soaking the blanks may then be sponged to speed the de-oxidizing action and rinsed with a high velocity spray of hot water.

In this step all residual grit and dark scale of old oxide deposits are chemically attacked and removed. Re-oxidizing of the aluminum surfaces takes place almost instantaneously during the rinsing and thus a colorless oxide surface is re-formed on the metal. Longer soaking periods and harder sprays are equivalent to the preferred spong ing and rinse but are more time consuming.

Drying and coating
Following the deoxidation step, the blanks are preferably dried by any suitable method such as room drying so as to avoid dilution of the Teflon coating dispersion when it is applied.

The method of applying a coating to the aluminum metal surfaces may be any of the conventional methods such as flowing, spraying or brushing. However it is to be noted that in practising the present invention a transparent nearly colorless Teflon is used, "Teflon" #30 or #30B being the Du Pont Company designation of a clear pure Teflon. An aqueous dispersion is flow coated
with the blanks placed at an angle of about 25° from the vertical to allow suitable drainage. The coating is then air dried and thus takes on a white appearance of the normal unsintered Teflon. A standard sintering operation is then performed in a suitable oven at a temperature of 700–725° F. By coating as described a smooth surfaced Teflon layer of transparent nature will adhere tenaciously to the aluminum blanks and result in a clear brightly finished article for cooking purposes. If increased thickness is desired, a second coating may be applied.

The result of the above described process is an unusually light color of the coated metal, the Teflon being colorless and almost entirely transparent. Insofar as is known the use of hard and sharp jagged grit of cast iron and a deoxidation cleaning step has not been heretofore suggested in the Teflon coating of aluminum blanks, the most conventional prior methods being the coating of blanks with a pigmented primer before the application of the Teflon. In the present method the deoxidizer chemically attacks and removes any residual iron grit and other dark metallic scale without harming or etching the aluminum surfaces. The result is a clean colorless new oxide re-formation on the blank to preserve and maintain a bright aluminum finish beneath the transparent Teflon.

What is claimed as novel and desired to be obtained by Letters Patent of the United States is:

1. The method of coating aluminum metal surfaces with polytetrafluoroethylene which comprises the steps of washing the surfaces with a mild alkaline cleaner by means of a high velocity spray and completely rinsing and drying; grit blasting the surfaces with an angular grit of cast iron having hard, sharp, jagged edges, the grit size being on the order of SAE classification #80 while constantly replenishing the grit to maintain a seventy to eighty percent sharp grit content; air blasting and repeating the first washing and rinsing steps; then soaking the surfaces in an aluminum deoxidation solution and spraying to remove residual grit and scale and thereby re-oxidize the surfaces with a clean, colorless oxide coating; then applying a coating of an aqueous dispersion of pure colorless polytetrafluoroethylene and drying and sintering the same.

2. In the method of preparing aluminum surfaces for coating with polytetrafluoroethylene which includes grit blasting said surfaces preceded and followed by mild alkaline solution spray cleaning and rinsing treatments, the improvement which consists in blasting the surfaces with an angular iron grit having hard, sharp edges and of a size on the order of SAE classification #80, and after said second cleaning and rinsing treatment, soaking the surfaces in an aluminum deoxidizing bath and thereafter thoroughly rinsing the same and re-oxidizing the metal surfaces to impart an appearance characterized by the bright and light aluminum coloration.

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RICHARD D. NEVIUS, Primary Examiner.

JOSEPH B. SPENCER, Examiner.

R. S. KENDALL, Assistant Examiner.