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EXAMINER 64

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METHOD FOR REMOVING CARBONACEOUS DEPOSITS FROM ALUMINUM MOLDS

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This invention relates to a method for removing carbonaceous deposits from metal surfaces. More particularly the invention is concerned with the removal of adherent carbonaceous deposits from the metal molds employed in the manufacture of rubber articles and the like. The invention further relates to a novel composition for accomplishing such removal of built-up carbon deposits without adverse effect on the metal.

In the manufacture of rubber articles the batch ingredients are placed in a mold designed to yield the desired object. The molds are usually constructed of aluminum but steel molds or stainless steel may also be employed. The batch in the mold is subjected to heat which serves to form the desired object and, on completion of the process, this is released from the mold.

In the course of the process, carbon and carbonaceous deposits may become baked on the mold. These must be removed before the mold can again be employed to produce a satisfactory product. In removing the carbonaceous deposits it is, of course, essential that the mold be not damaged. It is further desirable that the deposits be removed rapidly so that it does not become necessary to tie up considerable quantities of expensive molds in cleaning operations.

Many attempts have been made to remove the adherent carbonaceous deposits with desirable speed of action and with freedom from damage to the molds but none has proven entirely satisfactory. For the most part the compositions have consisted of organic solvents in various combinations and proportions, such solvents as aniline, alcohol, benzol, ethylene dichloride, kerosene, dichlorobenzene, and the like, being examples of those employed. These have not been highly effective in removing the hard adherent deposits of carbonaceous material. Alkaline substances have likewise been tried but have not shown much promise in removing the deposits. They must also be used in buffered combinations and with caution to avoid damage to the aluminum molds. For the same reason, acids, particularly the stronger inorganic acids, have been generally avoided because of their known adverse effect on the metal. Cresylic acid has been employed in compositions for cleaning aluminum but is not effective as an agent for removing the adherent carbonaceous deposits.

It is thus an object of our invention to provide a means and a method for rapidly and effectively removing such built-on carbonaceous deposits from aluminum and other metallic molds. It is a further object of the invention to accomplish the removal of such deposits without any significant adverse effect on the mold itself. Other objectives of the invention will appear hereinafter.

The above objectives are obtained by treating the metallic molds with adherent carbonaceous deposits with a novel composition consisting of an aqueous mixed solution of chromic acid and sulfuric acid, the chromic acid being dominant and the ratio of chromic acid to sulfuric acid being controlled to give the desired removal of the

carbonaceous deposits from the metal surface without causing any significant damage to the metal.

When the molds are treated with this novel composition and then washed with water, the adherent carbonaceous deposits are readily removed and, at the same time, no significant damage to the molds is observed. In addition, it has been found that this treatment appears to form a film on the surface of the mold which serves to place it in a condition whereby the molded object next prepared therein becomes readily released from the mold and has no tendency to stick thereto. This is an important advantage as sticking of molded articles to molds may become a serious problem, causing much spoilage of finished articles, and requiring the use of various types of mold release agents.

The composition of our invention consists essentially of an aqueous mixed solution of chromic acid and sulfuric acid, the ratio of chromic acid to sulfuric acid being 1.67:1 to 10.0:1, on a weight basis. In practice from 20 to 36 parts chromic acid are employed with 2 to 12 parts sulfuric acid and 300 to 1,000 parts water, all parts by weight, with the acids maintained within the proportions noted above with respect to each other.

For convenience in preparation and in shipping the composition may be prepared as a concentrate to be diluted at point of use. A preferred composition for such a concentrate consists essentially of the following, percentages being expressed on a weight basis:

	Percent
Chromic acid	28
Sulfuric acid	8
Water	64

The composition is conveniently and simply prepared by adding the sulfuric acid to the water and then dissolving the chromic acid in the dilute sulfuric acid solution. One part of the concentrate composition may be diluted with from about three parts to about ten parts water when employed to remove carbonaceous deposits from aluminum molds.

In the above compositions the term chromic acid refers to high purity grade chromic acid flakes of 99% plus chromic acid content. The term sulfuric acid refers to electrolyte grade 66 degree Baumé acid, containing 93.19% sulfuric acid. If acids of other strengths are utilized in the composition, their proportions must be adjusted accordingly. Extreme purity of the acids is not essential.

The method of applying the composition to accomplish removal of adherent carbonaceous deposits from aluminum molds may be illustrated by the following example.

Example

100 parts of the concentrated composition noted above, containing 28% chromic acid, 8% sulfuric acid and 64% water by weight, are diluted with 300 parts water in a suitable tank or other vessel. The diluted solution so prepared is heated to about 75 degrees centigrade. Aluminum molds, having thereon adherent carbonaceous deposits derived in the course of manufacture of rubber articles, are dipped into the heated solution and are maintained in contact therewith until the carbonaceous deposits have softened and loosened from the surface of the metal. The molds are then transferred to a second tank where they are washed with hot water to remove the loosened deposits and residual acidity from the metal. The molds, after this treatment, are again ready for use in the manufacture of rubber articles.

The above example is illustrative of the method of carrying out the invention and is not to be considered as

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limiting the scope thereof except as herein specified. The time required for contact of the metal with the composition will vary depending on the nature and thickness of the built-up carbonaceous deposit. At the temperature of 75 degrees centigrade, specified in the above example, a contact period of from about 5 to 15 minutes is usually ample for removing the adherent deposits from the molds. The temperature employed is not critical and even ordinary room temperature may be used, but as the temperature is lowered longer periods of time will be required to effect removal of the deposits from the molds.

As to mode of operation of the process, the mixture of acids appears to dissolve at least partially the adherent carbonaceous deposit. The remainder of the deposit is softened and loosened so that it is readily removed from the surface of the metal by the succeeding water washing. The chromic acid acts as a protective mechanism, forming an oxide film on the metal and thus preventing its attack. Chromic acid, employed alone, is not, however, effective in removing the carbonaceous deposits. The addition of sulfuric acid in correct proportion results in a composition which can be employed successfully for removing the carbonaceous deposits from the aluminum molds without causing any significant damage to the metal. Too much sulfuric acid cannot be employed in the composition since it would then not be inhibited from attacking the metal. Likewise the amount of water present in the composition must be controlled for too strong a mixture will attack the metal while too dilute a mixture will not effectively remove the adherent deposits from the metal. The operable limits of our invention have been described above and are set forth in the claims.

What we claim is:

1. The method of removing adherent carbonaceous deposits from aluminum molds without causing significant damage to the molds, comprising treating the aluminum molds and adherent carbonaceous deposits, for a period of time sufficient to loosen the carbonaceous deposits from the surfaces of the aluminum molds, with a composition consisting essentially of an aqueous solution of from 20 to 36 parts by weight of chromic acid and from 2 to 12 parts by weight of sulfuric acid in from 300 to 1,000 parts water, the chromic acid being present in from 1.67 to 10.0 times the amount of sulfuric acid by weight, then washing the aluminum molds with water.

2. The method of removing adherent carbonaceous deposits from aluminum molds comprising contacting the aluminum molds, for a period of time sufficient to loosen the adherent carbonaceous deposits therefrom, with a composition consisting essentially of 28 parts by weight of chromic acid, 8 parts by weight of sulfuric acid, and from 300 to 1,000 parts by weight of water, then washing the molds with water.

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