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MOLD RELEASE EMULSION

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This invention relates to a mold release agent suitable for use in the Croning process for sand casting of metal articles.

In the Croning process temporary casting dies or shell moldings consisting of resin and sand composition are molded from a master metal pattern either manually or by recently developed fully automatic machines. Suitable resins for use in these sand-resin shell molds are those of the urea-, melamine-, furane- or phenol-formaldehyde type. The metal pattern may be formed of iron, steel, magnesium, aluminum or copper and its alloys. The recent development of automatic machines which form, cure and eject the completed shell molds has made the sand casting process available for mass production of metal parts. As a result, this process has become of major importance in the foundry industry.

In the past, mold release agents containing organosiloxane compounds have been found to be of exceptional value for separating the resin-sand shell molds from the metal patterns. In spite of these excellent release characteristics occasioned by the use of organosiloxanes, difficulty has been experienced due to a gradual mold build-up. This mold build-up caused by the gradual accumulation of mold particles on the pattern results ultimately in altering the dimensions of the shell to such an extent that pattern cleaning becomes necessary. Thus, the molding machine is closed down from time to time to clean the master pattern. This entails a loss to production and an increase to unit cost. Actually, mold build-up indicates the failure of the release agent to entirely separate all of the molding from the pattern. The amount of mold material left on the pattern on any single release is, of course, very small.

It is the object of this invention to largely eliminate the above mentioned mold build-up and thereby to effect greater efficiencies and lower production costs.

This invention concerns a mold release emulsion composed of 1 to 75 per cent by weight of organopolysiloxane fluids, 1 to 6 per cent by weight emulsifying agents, 2 to 20 per cent by weight finely divided silica and 20 to 90 per cent water.

The organopolysiloxane fluids suitable for use in our invention have silicon bonded hydrocarbon radicals selected from a group consisting of methyl, ethyl, and phenyl radicals, and have 1.9 to 3 hydrocarbon radicals per silicon atom. Organosiloxane fluids such as dimethylsiloxane, diethylsiloxane, phenylmethylsiloxane, hexamethyldisiloxane, diphenyltetramethyldisiloxane, and

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copolymers thereof are operative in this invention. In addition, the siloxanes may contain limited amounts of monoorganosiloxane units in which the organo radical is methyl, ethyl or phenyl. The defined siloxanes may have any viscosity but preferably they have viscosities in the range of 100 to 5,000 centistokes.

Any finely divided silica such as diatomaceous earth, synthetic colloidal silicas, fumed silica, precipitated silicas, aerogels and xerogels can be used in this invention. It is preferred that the silica have an average particle size of less than 5 microns since such particles are more easily dispersed and relatively free from settling.

The emulsifying agents employed in this invention are commercially available materials and may be of either the cationic, anionic or nonionic types. Examples of such materials which are operative are morpholine salts of fatty acids where in the fatty acid contains from 12 to 18 carbon atoms such as morpholine oleate and morpholine stearate; acetates of n-primary amines having from 12 to 18 carbon atoms in the amine chain such as n-dodecyl amine acetate, n-octadecyl amine acetate, n-octadecenyl amine acetate and n-octadecadienyl amine acetate, monoesters of polyethylene glycols and fatty acids of 12 to 18 carbon atoms such as hexaethylene glycol mono-oleate; alkylated arylpolyether alcohols and alkali metal salts of alkylated arylpolyether sulfates. A commercial sodium salt of an alkylated arylpolyether sulfate is available under the trade-name of Triton 771.

The order in which the various ingredients of applicant's composition may be added can be varied. The preferred method of preparation, however, is as follows:

The organosiloxane fluid and part of the emulsifying agent are mixed in an agitator. Separately, water and the balance of emulsifying agent are also mixed together by suitable means. The water phase is then added to the siloxane phase, stirred and passed through a colloid mill, homogenizer or the like. This dispersion is finally added to silica well wet with water and again passed through suitable dispersing means. This mold release composition in its emulsion form may be applied in manners well known to the art such as by brush or spray.

The following examples show how this invention may be practiced. These examples are illustrative only and the invention is in no way limited by them.

Example 1

A mold release emulsion was prepared in the

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following manner: 1.25 pounds of oleic acid and 17.75 pounds of dimethylsiloxane fluid were mixed in an agitator. In a separate container 0.25 pound of a sodium alkylated arylpolyether sulfate and 0.875 pound of morpholine were dissolved in 5 pounds of water. This water solution was then added to the siloxane-oleic acid and agitation continued until homogeneity was obtained. The resulting mixture, which may be called the thick phase, was passed through a colloid mill. Separately, 2.25 pounds of an aerogel, commercially known as Santocel C, was thoroughly wet down with 23.125 pounds of water. The thick phase containing the polysiloxane was added to the wet-down Santocel and suitably mixed and then dispersed by means of a colloid mill. The foregoing process resulted in an emulsion having the following composition in percentages by weight:

	Per cent
Dimethylsiloxane fluid.....	35½
Santocel C (Silica aerogel).....	4½
Oleic acid.....	2½
Morpholine.....	¾
Sodium salt of alkylated arylpolyether sulfate (Triton 771).....	½
Water.....	56¼

The above emulsion was sprayed on a master pattern once each cycle in a continuous shell molding machine without the formation of noxious mold build-up for over a month. The use of previous emulsions composed of polysiloxanes or organic compounds resulted in mold build-up which made pattern cleaning necessary at least once every day.

Example 2

Compositions corresponding to that of Example 1 were prepared using the following commercial silicas:

Ludox—Colloidal silica, dispersed (30%) in water
HiSil—Precipitated silica gel
Superflos—Diatomaceous earth
Degussa—Fumed silica

All of these compositions gave excellent release when used in the Croning or shell molding process, and they gave no indication of mold build-up.

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Example 3

Mold release emulsions were prepared in the proportions and manner of Example 1 using the following polysiloxane fluids:

Diethyl siloxane
Phenylmethyl siloxane
Ethylmethyl siloxane

All emulsions prepared gave excellent release and were free of mold build-up when tested in the Croning process.

That which is claimed is:

1. A mold release emulsion consisting essentially of (1) from 1 to 75 per cent by weight of organosiloxane fluids, said organosiloxanes having from 1.9 to 3 hydrocarbon radicals selected from the group consisting of methyl, ethyl and phenyl radicals, per silicon atom, (2) from 2 to 20 per cent by weight finely divided silica, (3) from 1 to 6 per cent by weight emulsifying agents selected from the group consisting of morpholine salts of fatty acids having from 12 to 18 carbon atoms in the acid chain, acetates of n-primary amines having from 12 to 18 carbon atoms in the amine chain, monoesters of polyethylene glycols and fatty acids having 12 to 18 carbon atoms in the acid chain, alkylated aryl polyether alcohols and alkali metal salts of alkylated aryl polyether sulfates and (4) from 20 to 90 per cent by weight water.

2. A mold release emulsion as in claim 1 wherein the organosiloxane fluid is dimethylsiloxane.

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