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TREATMENT OF MOLTEN LIGHT ALLOYS

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This invention relates to the treatment of molten light alloys, by which term is to be understood magnesium, aluminium, alloys of these two metals and alloys of either or both of these metals with other metals in which alloys, magnesium or aluminium or a mixture of these is the predominant constituent.

It is well known that the foregoing light alloys, when melted, dissolve substantial quantities of hydrogen, originating for example from the dissociation of moisture from the atmosphere or introduced with the common additives to such metals. On solidifying the molten light alloys containing dissolved hydrogen, much of the hydrogen comes out of solution, giving rise to the presence of minute bubbles or porosity in the solid metal.

It is common practice to attempt to remove dissolved hydrogen from light alloys whereby an inert gas, for example, nitrogen or argon is bubbled through the molten metal before casting. A drying system for the inert gas is required and, even when the gases are thoroughly dried, light alloys with very low hydrogen content are rarely obtained. Chlorine gas or chlorinated hydrocarbons which volatilise at the temperature of the molten metal have been used for the same purpose, but it has been found that large quantities of unpleasant fumes are produced during their use.

The present invention has for an object to provide a method of removing the dissolved hydrogen from molten light alloys wherein the foregoing difficulties are avoided or minimised. The operation is referred to hereinafter as de-gassing.

According to the present invention a method of de-gassing light alloys comprises flushing through the molten light alloys carbon monoxide and/or carbon dioxide. It has been discovered, rather surprisingly, that degassing with the oxides of carbon may be effected without giving rise to undesirable inclusions in the cast metal.

The oxides of carbon may be provided as such, e.g., supplied from cylinders of the compressed gases or, in the case of carbon dioxide, supplied in the form of the solid (Dry Ice). These, however, are less preferred methods since the former requires the provision of cylinders and the latter involves a serious reduction in the temperature of the molten metal.

Preferably according to the invention the carbon monoxide or dioxide is generated in situ by adding to the molten metal a solid substance which, at the temperature of the molten light alloy, will decompose to yield the required gas, which then bubbles freely through the molten metal.

Thus for example, carbon dioxide may be generated in the molten light alloy by adding thereto a carbonate which decomposes at the temperature of the molten light alloy. Usually the alloy will be at a temperature in the range 580 to 800° C. A suitable carbonate for this use is magnesium carbonate. If a carbonate is used which does not itself decompose to yield carbon dioxide at the temperature of the molten light alloy, its decomposition may be achieved by including with it a composition of which the ingredients, at the said temperature, react exothermically (e.g., a mixture of aluminium and an oxidising agent therefor such as iron oxide), the temperature thus achieved by the exothermic reaction being sufficient to decompose the carbonate.

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Alternatively a carbonate which does not itself decompose at the temperature of the molten light alloy may be introduced in admixture with a substance which will react with the carbonate, at the said temperature, to generate carbon dioxide. Suitable substances for this purpose are alkali metal (e.g., sodium and potassium) silicofluorides and borofluorides.

Instead of a carbonate there may be used an oxalate, e.g., calcium or sodium oxalate. These oxalates decompose, at the temperature of the molten light alloy, to generate carbon monoxide and carbon dioxide.

In a further form of the invention the added substance is a mixture of cyanamide and an oxidising agent (e.g., sodium nitrate). Such a mixture, at the temperature here under consideration, will generate carbon dioxide with usually a proportion of carbon monoxide.

In a still further form of the invention the added substance is a mixture of carbon or carbonaceous material (which is preferably finely divided graphite but may be carbon black) and an oxidising agent, e.g., a nitrate, peroxide, persulphate, chlorate or phosphate, preferably of an alkali metal or less preferably of an alkaline earth metal. In this case it is convenient though not critical, to employ the carbon and the oxidising agent in substantially stoichiometric proportions.

Mixtures of any of these solid additives may be employed. To limit the rate of the reaction, the additive compositions may contain a diluent which may be inert or may participate in the reaction to a limited extent, e.g., sodium chloride, calcium fluoride, marble dolomite, zircon or grog (brick dust) but generally at least 5% of the additive will consist of the carbon-generating substance or ingredients.

It is important that the moisture content of the additives be kept to a very low level. The moisture content of the additive is preferably not greater than 1% of its weight and optionally does not exceed 0.25% of its weight. It is accordingly often desirable to subject the additive to drying at a temperature below the temperature at which decomposition sets in, in order to reduce its moisture content to within the indicated limits. No difficulty appears to arise in the practice of the invention from the dissociation of moisture in the ambient atmosphere. Especially in the case of carbon dioxide and mixtures rich therein, this may be due in part to a blanketing effect at the surface of the metal.

The compositions added to the molten light alloy according to the invention may also include substances having other special effects on the light alloy, e.g., grain refining agents or hardeners, e.g., salts of titanium or boron or mixtures thereof may be so included.

The compositions serving as the additives according to the present invention may be introduced into the molten light alloy as powders or granulated compositions, loose or in packets, e.g., paper packets, or aluminium containers, or may be preformed to tablet shape and added as tablets.

Preferred compositions according to the invention are those of which the active ingredients are carbon, e.g., in the form of graphite, and a nitrate, e.g., an alkali metal nitrate. It is found that the efficacy of these compositions may be further improved by including in them a small amount, e.g., up to 20% by weight of a fully chlorinated hydrocarbon, e.g., hexachlorethane, which appears to have a catalytic effect on the oxidation of the carbon and tends to reduce the formation of nitrogen oxide fumes.

It will be appreciated that the carbon oxide or mixture of carbon oxides need not necessarily be in a pure form. For example it may, when produced in situ, contain contaminants produced simultaneously, e.g., oxides of nitrogen, or it may be diluted with inert gases such as nitrogen

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or argon in small proportions or in such proportions that they contribute materially to the de-gassification.

The following are examples of compositions for use according to this invention:

Example I

The following composition was made up from the granulated or powdered ingredients as stated:

	Parts by weight
Sodium nitrate -----	36
Graphite -----	6
Hexachlorethane -----	3-5
Grog -----	30
Sodium chloride -----	23-25

The composition was tabletted and added to molten aluminium alloy (British Standards Specification 1490 L.M. 11) in an amount of 0.5% by weight of the metal. The resultant flushing with carbon oxides reduced the hydrogen content of the metal from 0.31 cc. per 100 gms. to 0.15 cc. per 100 gms.; the density of the metal was simultaneously increased from 2.74 gms. per cc. to 2.77 gms. per cc.

Example II

The following composition was made up from the granulated or powdered ingredients as stated:

	Parts by weight
Sodium nitrate -----	36
Graphite -----	6
Grog -----	30
Sodium chloride -----	28

This composition behaved similarly to that of Example I but was a little less vigorous in action.

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We claim as our invention:

1. A method of treating molten light alloys consisting essentially of at least one metal selected from the group consisting of aluminum and magnesium to remove therefrom gases including hydrogen which method comprises generating within the body of molten metal a sufficient quantity of at least one carbon oxide selected from the group consisting of carbon monoxide and carbon dioxide to remove said hydrogen from said molten alloy by adding to the molten alloy a mixture comprising carbon and an inorganic nitrate, said nitrate being present in at least substantially stoichiometric proportion relative to the carbon.

2. A method according to claim 1 wherein the inorganic nitrate is an alkali metal nitrate.

3. A method according to claim 1 wherein the mixture includes an inert diluent filler.

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