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D. S. CHISHOLM

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ATOMIZING MAGNESIUM AND ITS ALLOYS

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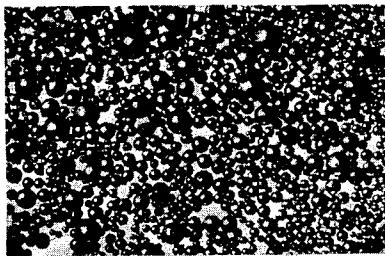


Fig. 1

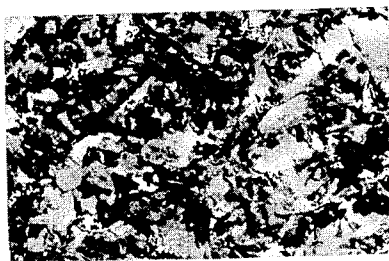


Fig. 2

INVENTOR.

Douglas S. Chisholm

BY

Griswold & Surdick

ATTORNEYS

UNITED STATES PATENT OFFICE

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ATOMIZING MAGNESIUM AND ITS ALLOYS

Douglas S. Chisholm, Midland, Mich., assignor
to The Dow Chemical Company, Midland,
Mich., a corporation of Delaware

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2 Claims. (Cl. 18—47.3)

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The invention relates to a method of atomizing magnesium and its alloys.

In my copending application Serial No. 159,370, filed May 1, 1950, there is disclosed a method of atomizing magnesium and its alloys which involves the impingement of a cool hydrocarbon gas (methane, ethane, propane, butane) against a thin stream of the molten metal. The cool gas breaks up the molten metal into fine spherical droplets which solidify into smooth spheres with an invisible protective coating. The coated particles thus obtained are unique in that, among other unusual properties they possess, they do not become united into a compact even under the application of compressive pressures as high as 100,000 pounds per square inch, and they are difficult to ignite with the flame of a match.

The present invention concerns a modification of the foregoing method of atomizing magnesium and its alloys and is based upon the discovery that by mixing with the hydrocarbon gas used to atomize the molten metal a sufficient quantity of a fog-forming liquid to at least saturate the atomizing gas with the vapor of the liquid and entrain some of the liquid in the atomizing gas as a fog, the solid atomized particles of metal obtained are jagged rather than smooth, are capable of being compacted under pressure, and readily ignite with the flame of a match. The invention then consists of the method hereinafter fully described and particularly pointed out in the claims, reference being had to the accompanying drawing.

In the said drawing, Fig. 1 is a photograph at a magnification of 7 diameters of a sample of atomized magnesium alloy made by atomizing with dry hydrocarbon gas, the sample being spread thinly on a flat white background. Fig. 2 is a similar photograph of a thinly spread sample of the same magnesium-base alloy atomized according to the method of the invention using water saturated natural gas containing entrained liquid water as a fog.

In carrying out the invention, the magnesium or magnesium-base alloy to be atomized is brought to the molten state and heated preferably not more than about 100 to 250 Fahrenheit degrees above the melting point. The molten metal is allowed to fall in a thin stream and a jet of hydrocarbon gas of the paraffin series at least saturated with fog-forming liquid is impinged against it. The size of the metal stream does not appear to be critical. Where very high rates of production are not required, a stream of diameter of 0.06 to 0.25 inch is generally satisfactory. The

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velocity of the hydrocarbon gas does not appear to be sharply critical and satisfactory atomizing can be had with gas pressures at the jet as low as 15 pounds per square inch and as high as 60 pounds per square inch or more. The diameter of the gas jet is preferably greater than that of the stream of metal.

The hydrocarbon gases which may be used contain from 1 to 4 carbon atoms, e. g. methane, ethane, propane, and butane. Mixtures of these gases may be used. They may be saturated with the fog-forming liquid in any convenient manner as by introducing the liquid into the gas as it flows to the jet. The amount of fog-forming liquid beyond that needed to saturate the atomizing gas is not sharply critical. An excess, beyond saturating amounts, of about 0.05 gram per cubic foot of the gas measured at atmospheric pressure is sufficient, although larger amounts may be used. For example, at 70° F. about 0.5 gram of water per cubic foot of the gas before compressing to jet pressure is sufficient to produce about 2 per cent by weight more water in the gas than is needed for saturation and produces a fog as the compressed gas issues from the jet. No harm appears to result from the use of a considerable quantity of the fog-forming liquid, i. e. far more than is needed to saturate the gas with the vapor of the liquid. An excess, over saturating amounts, of up to about 5 grams per cubic foot is tolerable. Over-saturating the atomizing gas with the fog-forming liquid to produce a fog therein is readily accomplished by spraying the fog-forming liquid into the gas stream on its way to the atomizing jet so that a mist or fog is formed in the gas jet stream before it strikes the molten metal to be atomized.

While water is the preferred fog-forming liquid, other liquids may be used having a boiling point between about 50° C. and 175° C. Examples of liquids boiling within the aforesaid range are octane, isobutyl alcohol, ethyl alcohol, methanol, propyl alcohol, toluene, benzene, xylene, and light distillate. These liquids are generally neutral, i. e. neither acid nor alkaline and do not actively attack the magnesium. They add to the cooling effect of the atomizing gas by abstracting heat from the molten metal as the liquid particles of the fog evaporate.

Referring to Fig. 2, as an example of the product of the invention, it will be seen that the atomized particles are characterized by jaggedness of shape, the surface is rough and is comprised of many sharp points and sharp edges. These particles resulted from atomizing a mag-

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nesium-base alloy having a nominal composition of 3 per cent of aluminum, 1 per cent of zinc, 0.5 per cent of manganese, the balance being magnesium. In the atomizing operation, the alloy was melted and heated to 1300° F. A jet of wet natural gas having a diameter of 0.25 inch was impinged upon a falling stream of the heated alloy having a diameter of 0.1 inch at the point of application of the gas jet. The atomizing gas, before the addition of the water, contained by volume 10 per cent N₂, 80 per cent CH₄, 8 per cent C₂H₆, and 2 per cent C₃H₈. To this atomizing gas was added about 0.5 gram of liquid water per cubic foot of the atomizing gas at room temperature which was then compressed to 20 pounds per square inch and impinged by means of a jet against the falling molten metal stream.

For comparison, the same alloy atomized in the same manner with the same hydrocarbon gas before the addition of water produced smooth spherical particles, as shown in Fig. 1.

The jagged particles obtained according to the invention, unlike those obtained with dry natural gas atomization, are compactable, nonfree flowing, and can be ignited with the flame of a match. They are more suitable for pyrotechnical purposes than the rounded particles.

I claim:

1. The method of converting a molten mass

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consisting of magnesium or alloy thereof into solid particles having a jagged form which consists in letting fall the molten mass in a thin stream and directing a jet consisting of paraffin hydrocarbon gas against the falling stream with sufficient velocity to break up the stream into particles, the hydrocarbon gas being selected from the group consisting of methane, ethane, propane, and butane and containing an entrained neutral liquid as a fog in amount between about 0.05 and 5 grams per cubic foot of the gas beyond that required for saturation at atmospheric pressure, said entrained neutral liquid having a boiling point between 50° and 175° C.

2. The method according to claim 1 in which the entrained neutral liquid is water.

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