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(54) Title: NOVEL WELDABLE ANTI-CORROSIVE ALUMINIUM-MAGNESIUM ALLOY CONTAINING A HIGH AMOUNT
OF MAGNESIUM, ESPECIALLY FOR USE IN AUTOMOBILES

(57) **Abrégé/Abstract:**

Weldable, high-magnesium-content aluminum-magnesium alloy consisting at least of 5 - 6 %w/w magnesium (Mg), 0.05 - 0.15 %w/w zirconium (Zr), 0.7 - 1 %w/w manganese (Mn), 0.01 - 0.2 %w/w titanium (Ti), at least 0.005 %w/w cerium (Ce), 0.05 - 0.5 %w/w of one or more elements from the scandium group and/or terbium (Tb), wherein at least scandium (Sc) is included, along with aluminum (Al), and unavoidable contamination does not exceed 0.2 %w/w silicon (Si).



ABSTRACT

Weldable, high-magnesium-content aluminum-magnesium alloy consisting at least of 5 - 6 %w/w magnesium (Mg), 0.05 - 0.15 %w/w zirconium (Zr), 0.7 - 1 %w/w manganese (Mn), 0.01 - 0.2 %w/w titanium (Ti), at least 0.005 %w/w cerium (Ce), 0.05 - 0.5 %w/w of one or more elements from the scandium group and/or terbium (Tb), wherein at least scandium (Sc) is included, along with aluminum (Al), and unavoidable contamination does not exceed 0.2 %w/w silicon (Si).

NOVEL WELDABLE ANTI-CORROSIVE ALUMINIUM-MAGNESIUM ALLOY CONTAINING A HIGH AMOUNT OF MAGNESIUM, ESPECIALLY FOR USE IN AUTOMOBILES

The invention relates to a weldable, corrosion-resistant, high-magnesium-content aluminum-magnesium alloy, which contains a ternary aluminum-scandium-zirconium phase as the essential component. Such an alloy is known from US 5,624,632, for example, and is of interest above all for applications in aeronautics due to its low density, high strength and corrosion resistance. Adding rare earth or rare earth-like elements generates dispersoids in the aluminum-magnesium alloy, which produce a higher strength and corrosion resistance according to the above US patent. The above US patent makes no statement as to the weldability of such an alloy.

An object of this invention is to provide a weldable, corrosion-resistant, high-magnesium-content aluminum-magnesium alloy, which is at least as good as the known alloy in terms of strength and corrosion behavior, and exhibits a high recrystallization threshold to go along with a good weldability.

According to one aspect of the invention, there is provided a weldable, high-magnesium-content aluminum-magnesium (AlMg) alloy consisting of at least 5-6 %w/w Mg;

0.05-0.15 %w/w Zr;

0.7-1 %w/w Mn;

0.01-0.2 %w/w Ti;

0.05-0.5 %w/w of an element from the scandium group or Tb, wherein at least Sc and at least 0.005 %w/w Ce are included;

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the balance being Al, and inevitable impurities not exceeding 0.2 %w/w Si. The scandium group contains the elements with ordinal numbers 21, 39 and 57 to 71 of the periodic table, that is the elements of the scandium group are the rare earth elements which are Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu.

This new alloy is particularly well-suited for body sheets due to its weldability and strength, and exhibits added titanium and cerium, which are not in the known alloy. An alloy with a ratio of manganese to scandium of less than two exhibits a particularly good corrosion behavior. Along with acting as a grain growth inhibitor, the titanium share not present in the known alloy helps to increase strength, since titanium can replace the zirconium in the ternary Al-Sc-Zr phase, wherein the solubility of titanium is lower than that of zirconium, however. The added cerium also helps

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increase strength, as well as the offset yield stress and thermal stability.

It has also been shown that scandium can be replaced by terbium, at least within certain limits. However, more terbium than the amount of scandium being replaced must be added to achieve constant properties.

A particularly strong and corrosion-resistant alloy contains at least 0.15 %w/w scandium. Lanthanidene is preferably added in amounts ranging from 0.05 and 0.35 %w/w, wherein this range relates to the total mixture when using a lanthanidene mixture. The alloy tolerates silicon contamination of up to 0.2 %w/w; primarily the dynamic properties deteriorate at above this level.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A weldable, high-magnesium-content aluminum-magnesium (AlMg) alloy consisting of at least 5-6 %w/w Mg;

0.05-0.15 %w/w Zr;

0.7-1 %w/w Mn;

0.01-0.2 %w/w Ti;

0.05-0.5 %w/w of an element from the scandium group or Tb, wherein at least Sc and at least 0.005 %w/w Ce are included;

the balance being Al, and inevitable impurities not exceeding 0.2 %w/w Si.

2. An AlMg alloy according to claim 1, wherein the element from the scandium group is Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb or Lu, or any combination thereof.

3. An AlMg alloy according to claim 1 or 2, wherein the ratio of Mn to Sc is less than 2.

4. An AlMg alloy according to claim 1 or 2, wherein at least 0.15 %w/w Sc is included.

5. An AlMg alloy according to claim 1 or 2, wherein 0.05-0.45 %w/w of a lanthanidene is included.

6. An AlMg alloy according to claim 4, wherein the lanthanidene is Ce, Nd, Eu, Gd, Dy, Ho or Er, or any combination thereof.

7. Rolled, extruded, welded or forged component for a motor vehicle consisting of an AlMg alloy as defined in any one of claims 1 to 6.