SUMMARY

7xxx series aluminum alloy armor components produced in accordance with the present disclosure exhibit an improved spall resistance. Processing parameters, as well as the alloy composition, are controlled in order to increase spall resistance, and to have high AP and FSP ballistic resistance.

The composition of the 7xxx series aluminum alloy is preferably selected in order to comprise Zr as at least one dispersoid forming element, more preferably Zr from about 0.04 to about 0.15 wt. %, which results in a further improvement of the performances.

In one aspect of the present disclosure, there is provided a method of producing an armor component, comprising :

a) casting a 7XXX series aluminum alloy to obtain an ingot, wherein said alloy comprises or consists essentially of
   - 8.4 wt.% ≤ Zn ≤ 10.5 wt.% ;
   - 1.3 wt.% ≤ Mg ≤ 2 wt.% ;
   - 1.2 wt.% ≤ Cu ≤ 2 wt.% ;
   - at least one dispersoid forming element, with a total content of dispersoid forming elements of at least 0.04 wt. %;
   - the remainder substantially including aluminum, incidental elements, and impurities;
b) homogenizing said ingot;
c) hot working said homogenized ingot to obtain a plate having a first thickness T1 ;
d) cold working the plate having the first thickness to obtain a plate having a second thickness T2, wherein $T2 = T1 - (x_1 * T2)/100$ and $0.5 \leq x_1 \leq 15$;
e) solution heat treating ;
f) quenching ; and
g) aging.

In another aspect of the present disclosure, there is provided an armor component produced from a 7XXX series aluminum alloy comprising or consisting essentially of:

- 8.4 wt.% ≤ Zn ≤ 10.5 wt.% ;
- 1.3 wt.% ≤ Mg ≤ 2 wt.% ;
- 1.2 wt.% ≤ Cu ≤ 2 wt.% ;

- at least one dispersoid forming element, with a total content of dispersoid forming elements of at least 0.04 wt. %;
- the remainder substantially including aluminum, incidental elements, and impurities;

wherein said 7xxx series aluminum alloy is in the form of a plate having a final thickness of about 0.5 to about 3 inches and is manufactured by:

a) casting said 7XXX series aluminum alloy to obtain an ingot,

b) homogenizing said ingot;

c) hot working said homogenized ingot to obtain an plate having a first thickness T1;

d) cold working the plate having the first thickness to obtain a plate having a second thickness T2, wherein $T2 = T1 - (x_1 * T2)/100$ and $0.5 \leq x_1 \leq 15$;

e) solution heat treating;

f) quenching; and

g) aging;

so as to achieve an improved spall resistance compared to an armor component obtained with the same manufacturing process except that said manufacturing process does not comprise cold working before the solution heat treatment.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 depicts an embodiment of the method used to determine the spall resistance score according to the present disclosure.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Unless otherwise stated, all compositional percentages are expressed in weight percent (wt.%), based on the total weight of the alloy. Alloy designation is in accordance with the regulations of The Aluminum Association known of those skilled in the art.

As used herein, the expression "up to" when referring to the amount of an element means that this elemental composition is optional, and includes a zero amount of this element. When the term "between" appears in the present application and claims, it is understood that the upper and lower numbers in the range are included. Similarly, "lower than" or "higher than" and such phrases include the numeral in the recited range.

The present invention relates to a method of producing an armor component, comprising :

a) casting a 7XXX series aluminum alloy to obtain an ingot, said alloy consisting essentially of

- 8.4 wt.% ≤ Zn ≤ 10.5 wt.% ;
- 1.3 wt.% ≤ Mg ≤ 2 wt.% ;
- 1.2 wt.% ≤ Cu ≤ 2 wt.% ;
- at least one dispersoid forming elements, with a total content of dispersoid forming elements of at least 0.04 wt. %;