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2,755,183

NICKEL-SILICON-BORON ALLOYS

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1 Claim. (Cl. 75-171)

This invention relates, as indicated, to nickel-silicon-boron alloys.

In my copending application, Serial No. 285,801, now Patent No. 2,743,177 there is disclosed a series of alloys containing nickel, silicon and boron, having unusual adherence properties, particularly the ability to adhere to stainless steel and to pure molybdenum.

The alloys, as thus disclosed, contain silicon, in amounts of from about 2.5% to about 5.5%, and boron in amounts of from about 0.75% to about 5.25%, with the balance or remainder substantially all nickel, it being understood, however, that wherever the expression "remainder substantially all nickel" was used in the specification and claims of said application, the expression was to be construed as including, whenever present in the alloy, small amounts of iron, manganese and chromium, in a total amount of less than 5%.

I have discovered, as the result of further research in connection with alloys of this type, that the properties of the aforesaid alloys in certain directions can be markedly improved by incorporating in the alloy, chromium and iron in definite combined amounts greater than used in the alloy of said copending application.

The use of both chromium and iron in the improved alloy is mandatory instead of optional, the chromium being present in amounts of from 2% to about 9.5%, and the iron being present in amounts of from 1% to about 5%, the sum of the two being not less than 5% nor greater than 12%. In general, the ratio of the chromium to iron in the alloy should be approximately 7:3, the iron always being less than the chromium.

By thus incorporating chromium and iron in the alloys, I find that in addition to the other advantageous properties obtained in the alloys, as described in said copending application, the following advantages are obtained:

(a) The tendency of the boron and silicon to become oxidized, in an oxidizing atmosphere, is greatly lessened.

(b) By thus retaining the boron and silicon in the alloy, the properties of the alloy are more accurately maintained.

(c) While the Rockwell hardnesses are of the same order of magnitude as the alloys of said copending application, the inherent hardnesses, i. e., the microconstituent hardnesses, are considerably increased, due to the presence of the chromium and iron in the ranges stated. The Knoop values of the three microconstituents are as follows:

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| (1) Euhedral light areas | 1581-1952 |
| (2) Depleted grains (probably suffering perieutectic reaction) | 1491-1670 |
| (3) Matrix material | 931-1080 |

In comparison, the same alloy, but devoid of chromium, has a matrix hardness of 769-980 and the hardness of the other constituent (dendrites) is 447-667.

The disclosure in said copending application is incorporated, by reference, in the present application. In this application, however, the expression "the balance being substantially all nickel," as used in the claims, is to be construed as precluding anything other than traces of impurities, such as manganese or phosphorus.

It is to be understood that various changes may be made in the proportions of the ingredients of the alloy, without departing from the spirit of the invention or the scope of the appended claim.

This application is a continuation-in-part of my copending application, Serial No. 370,879 now abandoned.

Having thus described my invention, I claim:

An alloy which is especially adapted for hard facing at relatively low temperatures, said alloy containing silicon in amounts of from about 2.5% to about 5.5%, boron in an amount of from about 0.75% to about 5.25%, and chromium and iron in significant amounts adapted to greatly lessen the tendency of the boron and silicon to become oxidized, in an oxidizing atmosphere, and to increase considerably the micro-constituent hardnesses of the alloy, the chromium being present in an amount of from about 2% to about 9.5%, and the iron in an amount of from about 1% to about 5%, the sum of the chromium and iron being not less than 5% and not more than 12%, the iron being always less than the chromium, the balance of the alloy being nickel.

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