METHOD OF CHROMIZING METAL

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1 Claim

ABSTRACT OF THE DISCLOSURE

This invention relates to chromizing ferrous and nickel-base alloys, and in particular, to avoiding the use of expensive reagent-grade chromous chloride in such chromizing process. In accordance with the invention, there is used in a molten-salt-bath chromizing process a bath containing halides of alkali metals and/or alkaline-earth metals, together with 0.5 to 10% of ferrous halide, e.g., ferrous chloride, and ferrochromium, preferably finely divided to the extent of 20 to 35 mesh, is added to the molten salt bath in amounts sufficient to initiate and sustain the chromizing reaction.

BACKGROUND OF THE INVENTION

The prior art known to the inventor consists of the article "Salt-Bath Chromizing" by L. E. Campbell et al., in volume 96 of the Transactions of the Electrochemical Society, pages 262 et seq. (1949). Salt-bath chromizing of various metals is described, but the authors either used expensive and hard-to-handle chromous chloride or reduced chromic chloride to the chromous salt in situ, a time-consuming (three-hour) process not suitable for commercial use.

SUMMARY OF THE INVENTION

The invention consists in initiating and sustaining a salt-bath chromizing operation by incorporating into the salt bath ordinarily used, i.e., one consisting essentially of alkali-metal and alkaline-earth metal halides, about 0.5 to 10% of ferrous halide, e.g., ferrous chloride, and adding ferro-chromium to the bath in sufficient amount for the chromizing reaction. Chromous halide, e.g., chromous chloride, is thus formed in situ and promptly used for chromizing. The invention is of use with the nickel-base alloys and the ferrous-base metals, including the plain-carbon, austenitic stainless, and ferritic stainless steels, but in view of the rapidity with which chromium diffuses into wholly ferritic materials, especially the wholly ferritic stainless steels of the kind disclosed in U.S. Patent No. 3,250,611, it is in the chromizing of such materials that the invention will find use to greatest advantage.

DESCRIPTION OF PREFERRED EMBODIMENT

A sample of steel consisting essentially of 10.5% chromium, 0.08% maximum carbon, about 0.6% titanium, about 0.4% silicon, balance iron and usual impurities, in the form of a test coupon ½ in. wide, 4 in. long, and 0.05 in. thick, was chromized in accordance with the invention. That is, said coupon was immersed for five minutes in a molten salt bath maintained at 1850° F., the bath consisting of a mixture of (a) about 85% barium chloride, about 9% sodium chloride, with (b) about 6 weight percent of ferrous chloride. Low-carbon ferrochromium was added in finely divided form (20 to 35 mesh) and in amount sufficient to initiate and sustain the desired chromizing reaction. The immersion was done with the bath maintained under a nitrogen atmosphere, though carbon dioxide, argon, or other unreactive gas might have been used. The test coupon was then handled as is customary in salt-bath chromizing practices: withdrawn from the bath, cooled in a non-oxidizing atmosphere, washed to remove salt therefrom, and dried.

Upon being subjected to numerous tests, including the ferric chloride spot test, boiling nitric acid test, water-vapor column test, CASS test, and cyclic-dip test, the sample exhibited results equivalent to those obtained with samples chromized for the same time and temperature with the use of a conventional bath containing chromous chloride. The resulting chromium coating was in all respects similar to that obtained by the use of a conventional chromous chloride containing bath.

I claim:

1. The improvement in a process for chromizing an object of metal selected from the group consisting of iron-base and nickel-base alloys comprising the steps of immersing said object in a molten-salt chromizing bath, withdrawing said object from said bath, cooling said object in a non-oxidizing atmosphere, washing said object to remove salt therefrom, and drying said object, which consists in initiating and sustaining the chromizing reaction occurring in said bath by providing a bath consisting essentially of halides of metals of the alkali-metal and alkaline-earth groups and about 0.5 to 10% by weight of ferrous halide and adding ferrochromium thereto in amounts sufficient to supply the chromium required for the chromizing operation.

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