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IRON BASE ALLOY

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2 Claims. (Cl. 75—123)

This invention relates to an iron base alloy, and more particularly to an iron base alloy having a melting point which is not in excess of about 975° C.

United States Patent 3,048,434, issued August 7, 1962, to H. V. Johnson and Fred P. Kirkhart discloses an improved metal filled coal electrode joint which is characterized by improved electrical conductivity and reduced tendency of the joint socket to split at elevated temperatures.

The improved electrode joint is of the conventional nipple and socket type and has at the top of the upper electrode socket a bore or chamber into which is placed a cylinder or plug of metal, such as iron. The metal, when heated to elevated temperatures, melts and flows through channels provided in the nipple or socket walls to fill all possible voids and clearances in the electrode joint. The greater electrical and thermal conductivity afforded by the metal as compared to carbonaceous pastes or cements, which were heretofore employed, aids in preventing the thermal gradients which ordinarily cause splitting of the electrode socket from developing.

However, since the joint in an electrode column will have a higher electrical resistance than the remainder of the electrode column, the temperature of the joint will rise faster and to a greater degree than the adjacent portions of the column. The larger this temperature differential is and the longer it is allowed to exist, the greater becomes the possibility of failure at the joint due to the difference in thermal expansion. Thus, it will be appreciated that if the joint is to be filled with a molten metal which will lower its resistance as proposed in the patent, it is desirable that the metal become molten at a relatively low temperature.

Accordingly, the principal object of this invention is to provide an iron base alloy which is suitable as a filler for carbon electrode joints and which is further characterized by a melting point less than about 975° C., and preferably in the range of from about 925° C. to 950° C.

The object of the invention is accomplished by an iron base alloy which comprises about 1.7 to 3.8 percent carbon, about 1.8 to 2.6 percent silicon, about 5 to 6 percent phosphorus, up to about 2.2 percent boron, the balance iron and incidental impurities such as manganese and sulfur. If present, the maganese may be tolerated in amounts up to about 0.8 percent, and the sulfur in amounts up to about 0.13 percent.

As indicated above, the iron base alloy of the invention must have a carbon content which is in the range of from about 1.7 to about 3.8 percent, with about 2.2 percent being preferred. Likewise, the silicon content must fall within the range from about 1.8 to 2.6 percent, with about 2.3 percent being preferred. Finally, a phosphorus content of between about 5 to 6 percent is required in the alloy of the invention. In addition, boron may optionally by present in amount of up to about 2.2 percent, and preferably up to about 1 percent.

It will be appreciated from the table below that the specified phosphorus and boron contents are not arbitrary

nor merely a matter of choice and that the melting point of an iron base alloy having a carbon and silicon content within the specified range is dependent on the phosphorus and boron content in a critical manner.

The melting point for the various iron base alloys reported in the table was determined by melting the alloy and immersing a thermocouple in the molten material and allowing it to cool while recording a cooling curve in order to obtain an indicated melting point. The alloys were synthesized by the addition of the indicated amounts of phosphorus and boron to a 3.5 percent carbon, 2.4 percent silicon cast iron. The numbers in parentheses indicate the actual analysis of the alloy after the melting and cooling.

Table

Alloy	Composition, Percent					Indicated Melting Point, ° C.
	C	Si	P	B	Fe	
1	3.5	2.4	-------	-------	Bal.	1,200
2	3.5	2.4	1.0	-------	Bal.	1,070
3	3.5 (2.2)	2.4 (2.3)	5.0 (5.5)	-------	Bal.	950
4	3.5	2.4	10.0	-------	Bal.	950–1,100
5	3.5 (1.8)	2.4 (2.5)	5.0 (5.8)	1.0 (.2)	Bal.	925
6	3.5 (2.1)	2.4 (1.9)	5.0 (5.7)	2.0 (2.0)	Bal.	975

As seen in the table, the melting point of Alloy 1 which contains no phosphorus or boron is approximately 1200° C. The presence of 1 percent phosphorus (Alloy 2) lowers the melting point to only about 1070° C. The presence of 5 percent phosphorus (Alloy 3) brings the melting point down to 950° C. which is within the desired range. Unexpectedly, however, the presence of 10 percent phosphorus (Alloy 4) jumps the temperature at which complete melting and liquification is achieved to as high at 1100° C.

With regard to boron content, while the presence of 1% (Alloy 5) is beneficial and lowers the melting point to 925° C. (from 950° C. without boron), unexpectedly the presence of 2 percent boron (Alloy 6) raises the melting temperature above that when no boron is present, namely, 975° C. A higher boron content than about 2.2 percent has been found to raise the melting point undesirably high.

It will be appreciated from a study of the table that a series of iron base alloys have been developed which have melting points well below the range of ordinary cast irons, and because of their ability to liquify entirely within a very narrow temperature range provide an excellent high conductivity filler material for prebaked carbon electrode joints.

I claim:

1. An iron base alloy consisting essentially of about 1.7 to 3.8 percent carbon, about 1.8 to 2.6 percent silicon, about 5 to 6 percent phosphorus, about .2 to 2.0 percent boron, and the balance iron and incidental impurities.

2. The alloy of claim 1 wherein said carbon content is about 2.2 percent and said silicon content is about 2.3 percent.

No references cited.

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