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METHOD OF IMPROVING THE WELDABILITY OF TITANIUM SHEET STEEL

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ABSTRACT OF THE DISCLOSURE

A method for improving the weldability of titanium sheet steel comprising coiling the sheet, as it comes off the hot mill at temperatures not lower than 1250° F.

BACKGROUND OF THE INVENTION

This invention relates to the treatment of sheet steel containing substantial amounts of titanium and is directed to a method of improving the weldability by controlled cooling of the hot mill product.

In the production of low carbon sheet steel it is customary to join the coils resulting from the hot rolling of individual slabs by flash welding so as to facilitate subsequent processing thru the pickle line and cold mill. The methods of flash welding are well known and no difficulties are encountered with failures of flash welds used to join coils of simple low carbon sheet steel which may or may not have been killed with aluminum and/or titanium. However, it has been found that when titanium is added in amounts of .20% or more to a low carbon aluminum killed sheet steel the basic characteristics of steel are affected to a degree where the standard flash welding procedures no longer produce welds which hold up during subsequent processing as thru a pickling line or cold mill.

maximum carbon and not less than .20% titanium. The broad and preferred ranges of steel compositions to which this invention is applicable are shown in Table 1. All compositions are shown as percentages based on weight with the balance being essentially iron.

TABLE 1.—COMPOSITIONS

	Broad	Preferred
Carbon	[1] .10	.04/.06
Manganese	[1] 1.00	.20/.50
Posphorus		1.015
Sulphur		1.030
Silicon	[1] 1.0	1.05
Aluminum	[2]	[2]
Titanium	[3] .20	.20/.50

[1] Maximum. [2] Sufficient to kill. [3] Minimum.

The practice of our invention consists simply in coiling sheet steels of the above compositions, as they come from the hot mill, at a temperature not less than 1250° F. and preferably at a temperature between 1250° F. and 1450° F.

The hot coiling objective can be obtained by heating the steel slabs to the high side of the normal temperature range, i.e. 2300° F., so that the hot band emerges from the finishing rolls at a temperature no lower than 1600° F.

The effect of coiling temperature on the flash welds used to join hot rolled coils of low carbon, aluminum killed, titanium sheet steel is demonstrated by the performance of the welds during subsequent processing in the pickle line and cold mill. The data summarized on Table 2 shows that a 1250° F. coiling temperature is critical in determining the performance of flash welds between individual coils as indicated by brackets.

TABLE 2.—PERFORMANCE OF FLASH WELDS

Coil No.	C	Mn	Al	Ti	Coiling temperature range, ° F.	Pickle line	Cold mill
1	.05	.32	.056	.29	1,400–1,450	Weld ok	Weld ok.
2	.05	.32	.064	.29	1,400–1,450	do	Do.
3	.05	.34	.057	.31	1,400–1,450	do	Do.
4	.05	.33	.055	.30	1,400–1,450	do	
5	.05	.36	.062	.31	1,400–1,450	do	Weld ok.
6	.06	.36	.065	.30	1,400–1,450	do	Do.
7	.06	.35	.059	.33	1,400–1,450	do	Do.
8	.06	.40	.065	.31	1,400–1,450	do	
9	.05	.30	.053	.27	1,235–1,150	Weld failed	
10	.05	.30	.056	.27	1,245–1,230	do	
11	.05	.33	.056	.32	1,285–1,260	do	
12	.04	.32	.064	.30	1,270–1,260	Weld ok	Weld ok.
13	.05	.32	.063	.29	1,080–1,070	Weld failed	
14	.05	.32	.063	.29	1,115–1,080	Weld ok	Weld failed.
15	.05	.31	.073	.29	1,160–1,150		
16	.04	.30	.076	.37	1,400 1,450	Weld ok	Weld ok.
17	.04	.30	.077	.38	1,155–1,130	do	Weld failed
18	.04	.30	.078	.38	1,120–1,105		
19	.05	.29	.057	.37	1,175–1,160	do	Do.
20	.04	.29	.058	.36	1,130–1,090		
21	.04	.29	.050	.39	1,160–980	do	Do.
22	.05	.31	.052	.39	1,110–1,055		

SUMMARY

It has been discovered that the weldability of a low carbon, aluminum killed sheet steel containing .20% or more titanium is affected by the manner in which the hot rolled coils are cooled and that weldability is improved by coiling said sheet steel at a temperature not lower than 1250° F. as it comes off the hot mill.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the preferred embodiment of this invention the low carbon aluminum killed steels contain no more than .10%

Coils **1–8**, **11**, **12** and **16** were produced by the method of this invention. The table clearly illustrates the effectiveness of the method in preventing weld failures.

The steels of this invention are particularly useful in the production of chromium coated sheet steel where it is essential to avoid the formation of chromium carbides because of their detrimental effect on the corrosion resistance of the coating. It is well known that under some conditions it is possible for carbon to migrate from the base metal to the coating to result in the formation of these undesirable chromium carbides. The presence of titanium in amounts greater than is necessary for deoxidation is believed to fix the carbon of

the base metal in the form of stable carbides and prevent the formation of chromium carbides in the coating.

The method of this invention makes possible for the first time the production of hot rolled titanium sheet steel which can be flash welded and subjected to further processing such as passing it thru a pickle line and/or a cold mill without failure of the welds.

We claim:

1. A method for improving the weldability of hot rolled, low carbon, aluminum killed sheet steel containing at least .20% titanium and the balance being essentially iron, comprising coiling said steel at a temperature not lower than 1250° F.

2. A method according to claim 1, in which the carbon in said steel does not exceed .10%.

3. A method according to claim 1, in which the carbon in said steel is between .04% and .06%, the titanium is between .20% and .50%, and the coiling temperature is between 1250° F. and 1450° F.

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