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Reduction of oxides formation at surfact depositsitson of wear-resistant alloys

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Abstract

The article deals with the issues of reducing the content of harmful substances when surfacing alloyed wear-resistant alloys. Studies have been carried out to determine the possibility of reducing the formation of oxides during surfacing of high-alloy wear-resistant alloys of the sormite type using a closed filter-ventilation system, which ensures minimal losses of alloying elements during the formation of the deposited layer. The loss of alloying elements during surfacing is influenced by a number of metallurgical and technological factors, including the share of the base metal in the deposited, surfacing modes, oxidation processes during melting of the electrode material and in the melt of the weld pool when interacting with the surrounding gas environment.

To reduce the oxygen content in the gas-air mixture formed during the surfacing process, special absorbent substances are used in a closed filtering and ventilation system, which reduce the course of oxidative processes with the formation of oxides of alloying elements. At the same time, the gas-air mixture is taken from the zone of arc burning and the weld pool, filtered through a system of special filters, in which solid and gaseous components of the welding aerosol are removed, after which the purified gas mixture is used as gas protection during surfacing.

We used powder tapes containing a mechanical mixture of powder components and a complex-alloyed alloy in the core. A complex-alloyed alloy, an alloy previously melted in an induction furnace, containing the necessary alloying elements. Particles of the required sizes were obtained by hydrogranulation, which were then introduced into the core of a flux-cored tape. The indicated flux-cored strips provided the same chemical composition of one alloying system in the deposited layer. After surfacing, the chemical composition of the deposited metal was determined for the content of carbon, manganese, silicon, nickel. The use of a closed filtering and ventilation system makes it possible to reduce the formation of oxides of alloying elements, which requires the determination of specific parameters for each surfacing process. Creation and use of closed fil'tro vent system (CFVS), serve of the filtered air in area of surfacing and providing safe labour in the workplace of welder. It corresponds the international standard of ISO and norms of European Union. Therefore, to execute a requirement to impermissibility of hit of harmful questions in an atmosphere concordantly Kiotskomuo and to Parisian protocols.

Key words: electrode materials, surfacing, alloying elements, welding aerosols, oxidation processes, closed filter ventilation system, deposited metal.

Introduction

Development of technological process of deposition of wearproof alloys with providing of decline of formation of oxides and losses of alloying elements in a deposition metal. Exposition of basic material. Creation and use of closed fil'tro vent system (CFVS), serve of the filtered air in area of surfacing and providing safe labour in the workplace of welder. It corresponds the international standard of ISO and norms of European Union. Therefore, to execute a requirement to impermissibility of hit of harmful questions in an atmosphere concordantly Kiotskomuo and to Parisian protocols.

Literature review

Substantive provisions on the rational alloying of metal and forming of wearproof phase are in-process [2] Safronov in fundamentals of rational alloying of alloys presented. Substantive provisions are in-process Livshits [3] expounded on alloying of deposition metal, intended for work under various conditions of shock, abrasive wear, and also influence of alloying elements on formation of carbidic phase and matrix - basic constituents of alloy.

Purpose of the article

Development of technological process of deposition of wearproof alloys with providing of decline of formation of oxides and losses of alloying elements in a deposition metal. Exposition of basic material to apply CFVS.

Main materials

For surfacing apply different deposition materials, different welding-technological properties, composition and alloying elements, providing the receipt of the required composition and properties in a depositd layer.

As a result of melting of electrode metal and flowing of metallurgical processes in the area of burning of arc and welding bath, there is a selection in the atmosphere of different gases with formation of welding aerosols (SA). Formative SA consist of hard constituents of welding aerosol (HCWA) and gaseous constituents of welding aerosol (GCWA). Welding aerosols, contain harmful matters as a dust and gases, different oxides: CO, MNO, SiO_2, Cr_2O_3, NO, N_2O_3, So2, render negative influence on sanitary-hygienic terms in a working area [3-4].

The amount of harmful excretions depends on the modes of cladding, type of electrode material and its composition. For mechanized electric arc deposition powder-like band electrode materials are widely used. At deposition with the use of powder-like ribbon the content ofmaintenance of chemical elements in a deposited metal goes down due to formation of oxides of alloying elements as a result of their co-operating with oxygen of atmospheric air, that has influence on properties weld layer.

For diminishing the contet of oxygen in air-gas mixture, appearing in the process of deposition, the special absorbents in ZFVS, which reduce flowing of oxidizing processes with formation of oxides of alloying elements, are used. Thus air-gas mixture is taken from the area of burning of arc and welding bath, passes filtration through the system of the special filters TSSA and GSSA delete in which, whereupon cleared gas mixture is used as gas defence at deposition [5].

Researches were conducted with the use of powder-like ribbons which had different mandrels, but provided identical chemical compositions of the deposition metal. Powder-like ribbons, containing mechanical mixture of powdery components and complex-alloyed alloy in a rodmandrel, were used. The complex-alloyed alloy (ligature) is the alloy containing the necessary alloyed elements preliminary smelted in an induction stove.

The receipt of particles of the required sizes was produced by gidrogranulyacii, which was after entered in the complement of mandrel of powder-like ribbon. The indicated powder-like ribbons provided identical chemical composition of one system of alloying in a weld layer. Making of powder-like ribbons of necessary sizes was produced on machine-tools which provide the receipt of the One Articulata construction of furnace.

Cladding was conducted on the permanent modes: welding current 700-750 And, tension of arc 28-32 In, cladding 36 mcode/hour. After cladding n surfacing determined chemical composition of deposwited vtnal was was denermined threw on maintenance of carbon, manganese, silicon, nickel. For the receipt of reliable results of estimation produced for 10 measurings for every experiment. In the process of deposition from the area of burning of arc produced the selection of gas environment with the use of ZFVS.

During work of ZFVS different sorbents and filter elements were probed. General information about matters, recommended as a sorbent able to absorb oxygen is presented in table 1 [5].

Table 1

General information about the used sorbents

Name of sorbent	The biggest aesorbed molecules	Kinetic diameter Å
Yugavaralit	C_2H_4	3,6…3,9
Zeolite	$(C_4H_9)_3N$	8,1
Zeolite of W	SO_2	3,6
Zeolite of R- W	NO	3,6
Zeolite of L	$(C_4H_9)_3N$, $(C_4F_9)_3N_1$	8,1
Fozhazit	$(C_2F_5)_3N$	8,0
Stil'bit	H_2O, NH_4	2,6
Mordenit shirokoporistiy	NH_9	2,6
Natrolite	$(C_4F_9)_3N$	10
Zhismondin	N_2; O_2	3,6

The results of researches with the use of ZFVS (with the special sorbents) and different types of alloying charge in composition the rods of powder-like ribbon are smown in a table 2. Application of ZFVS allowed to delete from an air-gas environment, formed in a proces of cladding of TSSA and GSSA, to reduce the content of oxygen with the special sorbents.

Table 2

Maintenance of alloying elements in aweld metal with the use of ZFVS

Type of mandrel of powder-rod ribbon	Type of deposition	Type of surfacing composition of alloying deposition elements is in the metal of guy-sutures, %				
		C	Mn	Si	Cr	Ni
Mechanical mixture of components	Without the use of ZFVS	2,55	1,44	2,4	20,6	2,8
	With the use of ZFVS	2,8	1,8	2,99	21,6	2,92
Complex-alloyed ligatures	Without the use of ZFVS	2,70	1,4	2,04	20,4	2,66
	With the use of ZFVS	2,9	2,12	3,06	24,2	3.80

In 1 and 2 presented is chemical composition of weld metal, got at surfacing with the use of powder-like ribbons cored from mechanical mixture of components and complex-alloyed alloy with the use of ZFVS.

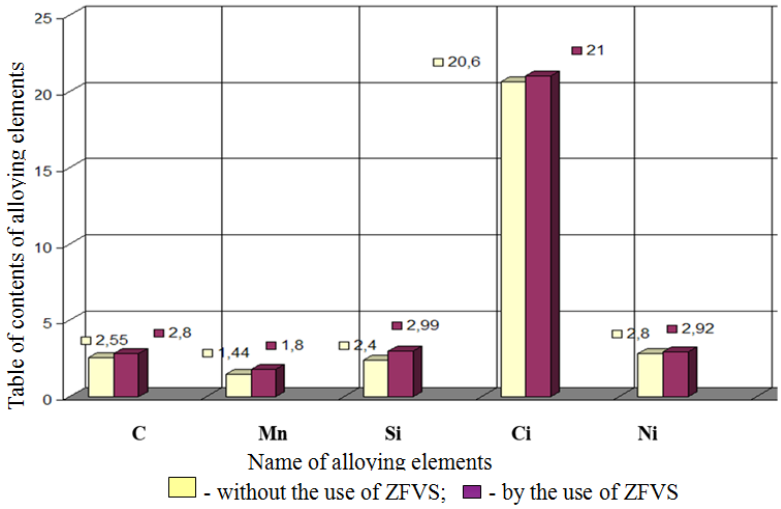

Fig.1. Chemical composition of depositiec metal at deposition a powder-like ribbon, containing mechanical mixture of components in composition a mandrel

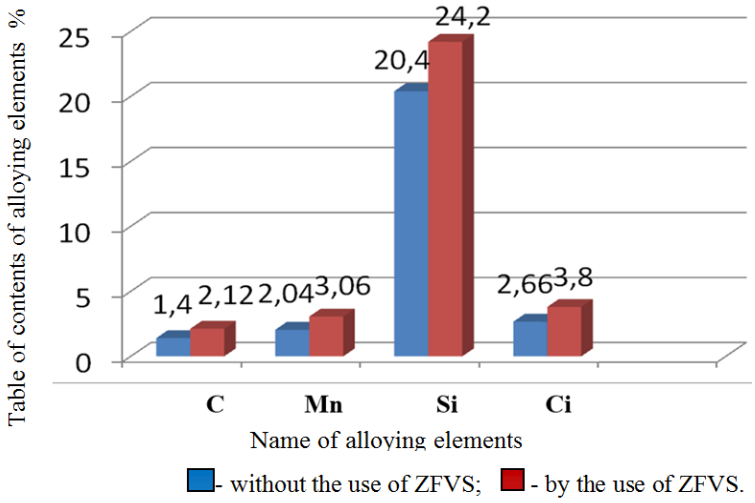

Fig.2. Chemical composition of deposited metal at surfacing a powder-like ribbon, containing the complex-alloyed alloy in Rod 's composition

The results of experiments testify to the reduction decline of oxidization of alloying elements in the process of deposition. At deposition of wear proof alloys it is possible to decrease oxidizing processes, but it is necessary to conduct the choice of sorbents which can maximally absorb harmful excretions, table.2.

Conclusions

1. The use of ZFVS in the area of burning of arc reduces of oxygen and formation of oxides, at the use of the proper sorbent, that is instrumental for preservation alloying elements in a weld metal.

2.Alloying elements in a deposited weld metal will allow to improve process of work-hardening of metallurgical machines, it is the real solution of task of wear of metallurgical machines and are the area of tribologoicheskikh researches.

3.For reduction of flowing of oxidizing processes at surfacing of high wearproof alloys of type of sormayt with the use of ZFVS as a sorbent it is recommended to use zhismondi.

4. Creation and use of closed fil'tro vent system (CFVS), serve of the filtered air in area of surfacing and providing safe labour in the workplace of welder. It corresponds the international standard of ISO and norms of European Union. Therefore, to execute a requirement to impermissibility of hit of harmful questions in an atmosphere concordantly Kiotskomuo and to Parisian protocols.

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Чігарьов В.В., Логвінов Ю.В. Зниження утворення оксидів при нанесенні поверхнево-активних речовин із зносостійких сплавів.

У статті розглядаються питання зменшення вмісту шкідливих речовин при наплавленні легованих зносостійких сплавів. Проведені дослідження з метою визначення можливості зменшення утворення оксидів при наплавленні високолегованих зносостійких сплавів сормітного типу із застосуванням закритої фільтрувально-вентиляційної системи, що забезпечує мінімальні втрати легуючих елементів під час утворення осаджених шарів. На втрату легуючих елементів під час наплавлення впливає ряд металургійних і технологічних факторів, включаючи частку основного металу в наплавленому шарі, режими наплавлення, процеси окислення при плавленні електродного матеріалу та в розплаві зварювального басейну при взаємодії з навколишнім газовим середовищем.

Для зменшення вмісту кисню в газоповітряній суміші, що утворюється в процесі наплавлення, в закритій фільтруючій та вентиляційній системі застосовуються спеціальні абсорбуючі речовини, які зменшують хід окисних процесів з утворенням оксидів легуючих елементів. При цьому газоповітряна суміш береться із зони дугового горіння і зварювального басейну, фільтрується через систему спеціальних фільтрів, в яких видаляються тверді та газоподібні компоненти зварювального аерозолю, після чого очищена газова суміш використовується як захист від газу під час наплавлення.

Ми використовували порошкові стрічки, що містять механічну суміш порошкових компонентів і складний легований сплав в серцевині. Сплавно-легований сплав - сплав, попередньо розплавлений в індукційній печі, що містить необхідні легуючі елементи. Частинки необхідних розмірів отримували гідрогрануляцією, які потім вводили в серцевину порошкоподібної стрічки. Зазначені порошкоподібні смуги забезпечували однаковий хімічний склад однієї легуючої системи у нанесеному шарі. Після наплавлення визначали хімічний склад наплавленого металу за вмістом вуглецю, марганцю, кремнію, нікелю. Застосування закритої системи фільтрації та вентиляції дає змогу зменшити утворення оксидів легуючих елементів, що вимагає визначення конкретних параметрів для кожного процесу наплавлення. Створення та використання закритої фільтрувальної системи фільтра (CFVS), що подає фільтроване повітря в зону наплавлення та забезпечує безпечну працю на робочому місці зварника. Він відповідає міжнародному стандарту ISO та нормам Європейського Союзу. Отже, виконати вимогу про неприпустимість потрапляння шкідливих питань в атмосферу відповідно Кіотського та Паризького протоколам.

Ключові слова: електродні матеріали, наплавлення, легуючі елементи, зварювальні аерозолі, процеси окислення, вентиляційна система із закритим фільтром, наплавлений метал.