UDC 669.295

G.A. Kolobov [(1)], professor, c.t.s.
S.A. Vodennikov [(1)], first pro-rector, d.t.s.
V.K. Lisitsa [(1)], профессор, d.t.s.
A.V. Bubinets′ [(1)], aspirant
K.A. Pecheritsa [(2)], general director

TECHNOLOGIES OF USING NONSTANDARD TITANIUM WASTES IN FERROUS AND COLOURED METALLURGY

[(1)] *Zaporozhe state engineering academy*
[(2)] *OAJ «Titanium Trade», Zaporozhe*

Titanium wastes are used in ferrous metallurgy for alloying, acidification and modification of steels and also in the production of standard and high-percent ferrotitanium. In coloured metallurgy, such wastes are used at the production of titanium-new slag and titanium tetrachloride, for alloying aluminum alloys, for secondary titanium alloys, for procurement and shaped casting, and also for producing titanium powders, titanium hydride and refractory titanium compounds.

Key words: titanium wastes, ferrous and coloured metallurgy, titanium-containing steels, ferrotitanium, titanium slag, titanium tetrachloride, aluminum alloys, secondary titanium alloys, titanium casting, powders, titanium compounds

Utilization of wastes in ferrous metallurgy. In ferrous metallurgy titanic wastes use in a production alloyed titanuimcontaining steels either directly, entering them in the process of smelting steels or mediated - through the use of them in the production of ferrotitanium. In both cases titan, contained in wastes, is lost irretrievably, id est. goes out outside of its circulation. In addition, there are used in ferrous metallurgy and titanic cast-iron, got as a by-product at melting of ilmenite concentrate in orethermal furnaces in the process of making of having a special purpose product - titanic slag.

Alloying of steels. Titanic wastes use for alloying and deoxidizing in productions carbon and low-alloyed steels, corrosion-resistant (non-rusting) steels, high-alloyed high-quality steels (for which application of standard ferrotitanium is not effective from high content in its silicon), and also in the productions of the steel and cast-iron shaped casting [1,2].

Wastes of titanic alloys, containing an aluminium, manganese and chrome, serve for alloying of most brands of martin steels and electrical steel. Wastes of alloys, containing a molybdenum, vanadium, chrome and zirconium, input in a charge for smelting of chrome-molybdenum-vanadium electrical steel and row of brands of martin steel.

Introduction of titanic scrap there are practiced at the end of teeming steels, modified by aluminium. At melting steels from a charge, containing the fair quantity of scrap and hereupon having high maintenance of nitrogen, nitride of aluminium appears on the borders of grains, reducing durability. At introduction of the fat free shaving of titan this phenomenon is succeeded to prevent.

Most researchers specify on irrationality of direct application of titan in one or another kind for the improvement of properties of steels and cast-irons. It is consi-

dered that more effective to use titanic wastes in the production of high-percent ferrotitanium.

Production of ferrotitanium. A ferrotitanium is used as titanuimcontainingая ligature is in the production of non-rusting and heatproof steels, and also at making of electric welding electrodes.

A standard ferrotitanium is got in a classic variant aluminothermetic renewal of ilmenite concentrate, containing the oxides of iron and titan. A standard ferrotitanium with the use of titanic wastes is produced by two methods: by aluminothermetic renewal and electro-furnace method. Both these methods allow to use in composition a charge wastes of titanic alloys: shaving in a pellected kind and caked and sheet wastes - in the ground up kind.

A high-percent ferrotitanium is got by the melt back of wastes of titanic alloys with the crow-bar of low- and medium-carbon steels. In the production of high-percent ferrotitanium use mainly cake titanic wastes, although can be used also bad quality spongy titan and shaving. For smelting of high-percent ferrotitanium use the induction channel furnaces of industrial frequency with a magnesite lining-up.

A high-percent ferrotitanium can be got and by the method of the electro-slag melting which allows to use as a feedstock shaving wastes [3].

Utilization of wastes in the coloured metallurgy. In the coloured metallurgy utilization of not standard wastes of titanic alloys, as well as wastes of spongy titan, can be carried out on different directions depending on quality of wastes and economic situation on products, got as a result of processing of wastes. At first, it is utilization of wastes in the production of spongy titan on two redistributions: making of titanic slag and making of titan tetrachloride. Utilization of wastes in the production of spongy titan abandons wastes in the sphere of titan circulation, however is not effective direction, because returns a metal to the initial stages of process of making of titan.

Making of titanic slag. In this case wastes use as part of charge at smelting of slag in ore-thermal furnaces. On this technology wastes enter in a furnace in a quantity 80-100 kg on 1.0 t of ilmenite concentrate after melting of concentrate in the period of polishing of slag.

Making of titan tetrachloride. In this case wastes of titanic alloys expose to chlorinating a gaseous chlorine or anodic chlorinecontaining gas. However this process is complicated by that in co-operating with chlorine not only titan but also all alloying components of titanic alloys enters. They can form chlorides or oxychlorides, soluble in the titan tetrachloride.

Alloying of aluminium alloys. Titan in castings aluminium alloys is promoted by firmness and grain glowed, id est. used as reinforcer and modifier [4]. The content of titan in aluminium alloys makes to 0,2 % on mass. For introduction to the aluminium of such quantities of titan a «titan-aluminium» ligature use with content of titan 5-10 %.

With the use of technologies hydrogenizion - dehydrogenization, mechanochemical growing and electrolytic affinage shallow from bad quality spongy titan and unstandard wastes of titanic alloys powders get for application in the most different

areas, including for making from them products by the methods of powder-like metallurgy.

By the method of self-propagating high temperature synthesis from unstandard titanic wastes refractory connections of titan (nitrides, carbides, carbonitrides) can be got, and by the method of the liquid-phase sintering – carbide-steels.

Conclusions. Titanic wastes in ferrous and coloured metallurgy use for the making of different products, applying technologies of alloying, deoxidizing, melting, chlorinating, renewal, mechano-chemical and thermo-chemical growing, electrolytic affinage, self-propagating high temperature synthesis, liquid-phase sintering shallow.

REFERENCES

1. **Комсток, Дж. Ф.** Титан в чугуне и стали [Текст] / Дж. Ф. Комсток; перевод с англ. – М. : ИЛ, 1956. – 356 с.
2. **Ситтиг, М.** Извлечение металлов и неорганических соединений из отходов [Текст] / М. Ситтигю ; перевод с англ. – М. : Металлургия, 1985. – 371 с.
3. **Паздников, И. П.** К вопросу оптимизации технологии производства высококачественного ферротитана [Текст] / И. П. Паздников, А. Я. Дубровский, А. В. Зеленский и др. // Титан. – 2005. – № 2. – С. 21-22.
4. **Добаткин, В. И**. Алюминиевые сплавы. Плавка и литье алюминиевых сплавов [Текст] / В. И. Добаткин. – М. : Металлургия, 1970. – 246 с.