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G.A. Kolobov [(1)], manager of department, c.t.s., professor
S.A. Vodenniokov [(1)], first pro-rector, d.t.s., professor
Yu.V. Mosejko [(1)], associate professor, c.p.s.
A.G. Kirichenko [(1)], associate professor, c.t.s.
V.V Pavlov [(2)], main engineer, c.t.s.
K.A. Pechritsa [(3)], general director
A.V. Karpenko [(1)], assistant

PROCESSING OF SCRAP FOR TUNGSTEN- AND MOLYBGENUMCONTAINING STEELS AND COMPLEXALLOY ALLOYS

[(1)] Zaporozhe state engineering academy,
[(2)] Zaporozhe metallurgical experienced-industrial plant of SE «Institute of titan»
[(3)] LTD. «Titan Trade», Zaporozhe

The review of technologies for processing of scrap of tungsten- and molybdenum containing steels and alloys as secondary raw materials for extraction from it tungsten, molybdenum and their compounds is given.

Keywords: tungsten, molybdenum, scrap of steels and alloys, processing, extraction.

The problem of processing for tungsten- and molybdenum steels has an important economic value. For processing of scrap of high speed steels more rational technologies processing presented, foreseeing extraction from scrap of all valuable are offered in a monograph [1].

Tungsten containing scrap can be processed in steel-smelting aggregates at the serve of scrap directly in a reactionary area. The got ferrotungsten, containing 12-30 % tungsten, is used for alloying in the hundred tone ladles of steels, containing 0.4-0.8 % tungsten.

Scrap of facing of high-speed steel expose to magnetic separation and the got faction with addition of lime milk is remelted in an arc furnace.

From a dross, appearing at thermal treatment or forging of special steels, it is suggested to extract *W*, *Mo*, *V*, *Ni*, *Co*, *Cr*, *Mn* on a chart, to supposing next operations: growing of dross shallow to faction a 0.51 mm, mixing with aluminum powder (or sulphurs) and warming mixtures to beginning of exothermic reaction. Upon completion of reaction a metal and slag divide.

The method of powder-like metallurgy foresees a few operations. In the beginning facing of high-speed steel breakage in a ball drum in the environment of organic liquid, which intensifies growing shallow and partly protects from oxidization. Powders, containing a 0.3 % oxygen, restore in dry hydrogen at the temperature 600-700 °C. Then powders press at pressure 687-981 МПа and sinter at the temperature 1250 °C with moving away of remaining oxygen. The subsequent hot forging of the sintered blank liquidates remaining porosity. On the last stage from a blank make an instrument and execute its thermal treatment.

At the chemical method of processing of shaving of tungsten containing steel of composition, %: 74-78 *Fe*; 12,5-14 *W*; ~1,0 *Mo* sintered its with saltpetre (*Na-*

NO_3) and soda (Na_2CO_3) in correlation 1 : 0,6 : 0,2. Cake lixiviate by water at 80-90 °C and S : L = 1 : 4. It is evaporated the got solution and slowly cools for the selection of sodium salt, and then process on ordinary technology on H_2WO_4.

Final tailings which appears at polishing of hard-tempered high-speed steel of P6M5 brand is paste-like mass, containing lubricoolant, products of wear of abrasive instrument and steel particle (~30 mas. %). At processing final tailing is preliminary dehydrated in the pseudo fluidized layer in the stream of hot air, and then expose to the oxidizing burning at the temperature 800 °C in the atmosphere of oxygen. Thus there is a sublimation of volatile oxides of tungsten and molybdenum. Maximal extraction of tungsten in oxides was 86 %, molybdenum - 98 % at the temperature of sublimation 1350 °C. At renewal of sublimation in hydrogen at the temperature of 900 °C get powders with the size of particles 1.5 mcm, containing for 50 % tungsten and molybdenum and two-quantity of vanadium, iron and chrome get. Such powders can be used for the receipt of ligatures of type (*W,Mo*)*C*, applied as basis cabrioles.

Many-stage technology, intended for processing of polishing final tailing of composition, %: 78.67 *WC*; 10.13 *Co*; 1.68 *SiC*; other carbides 6.8 includes the next stages: pyrolysis at the temperature 400 °C during 3 hours in the atmosphere of nitrogen for moving away from final tailing of organic matter, oil and moisture; nitric acid lixiviating of bundle (*Co*, *Fe*, *Ni*) at the temperature 50 °C with 20 % surplus HNO_3, S ^ L: = 1.5 (kg/l) during five hours at interfusion; a remain contains, %: 86.35 *W*(*WC*); 2.95 *Co*; carbides - at former level; oxidizing burning for conversion of carbides in oxides at the temperature 500 °C and serve 60 l/hour air during 3 hours; ammoniac lixiviating of WO_3; it is evaporate the got solution of paratungstate of ammonium, getting crystals $(NH_4)_{10}(H_2W_{12}O_{42})\cdot 4H_2O$, which at tempering at the temperature of 450 °C decompose, forming WO_3 with an outlet 88 %.

Scrap of molybdenum containing steels and complex alloy alloys are one of sources of secondary molybdenum raw material. For the complex processing of scrap of complex alloy alloys and steels apply hard oxidants as which it is suggested to use materials with high content of iron and nickel oxides. The results of tests of this technology showed high extraction of nickel from composition of the processed scrap in a ferronickel, and alloying elements (tungsten, molybdenum, chrome) - in a slag.

As the first stage of processing for scrap of superalloys on basis *Ni-Co-Cr* with additions of molybdenum, tungsten and niobium it is possible to examine treatment it's by pair of zinc. As a result of such treatment there is a crow-bar of crisp that facilitates extraction from him valuable components after grinding of material.

For processing of facing and polishing dust of instrumental steel, containing *Fe*, *Cr*, *Ni*, *Co*, *V*, *Mo*, *W* and particles of abrasives, apply the pressure lixiviating at the temperature 150 °C and pressure 1.0 МПа. So, as a result of the double pressure lixiviating of polishing dust it was extracted in solution, %: 100 *Mo*, 100 *V* and 95 *W*. At the subsequent lixiviating of remain of 15 % by muriatic acid in solution 93 % nickels were extracted and 90 % cobalt.

For extraction of molybdenum from scrap of high-alloy steel, containing ≥ 20 % nickel and/or cobalt and molybdenum, the method of oxidization and absorption of molybdenum in a slag, consisting of double oxide is offered.

At processing of the mixed scrap of heatproof molybdenum containing alloys they after depriving of fat are processed by dilute muriatic acid with blowing out of mash by oxygen (or by chlorine) for maintenance of oxidizing potential of solution at high level.

Conclusion. Scrap tungsten containing and special steels and alloys can be processed on a ferrotungsten and powders. At the chemical method of processing of facing and polishing final tailing get tungsten acid and tungsten anhydride. For extraction of tungsten and molybdenum from scrap of superalloys they are exposed to the oxidizing annealing or treatment by the pair of zinc. The hydrometallurgical method for processing of scrap of complex alloy molybdenum containing alloys allows to extract from them all valuable components as compounds.

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