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Method for Processing Non-Standard Molybdenite Concentrate

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ABSTRACT: Depletion of reserves, reduction in the quality of raw materials, the demand for rare metals and toughening requirements for the environmental safety of production require the creation of new and improvement of existing options for the processing of rare-metal raw materials. Involvement of non-standard concentrates in processing will increase the end-to-end extraction of the target metal from ore into a marketable product by at least 5%.

KEY WORDS: rare-metal, raw materials, molybdenum trisulfide, molybdenum, sodium, autoclave, copper-molybdenum, temperature, calcium containing, molybdenum concentrate.

I. INTRODUCTION

In recent years, the consumption of molybdenum has been continuously growing, which is due to increasing demand from manufacturers of heat-resistant alloys and stainless steels. Against the background of a decrease in the quality of mined ores caused by the depletion of reserves of existing enterprises, the problem arises of processing poor concentrates to produce ammonium paramolybdate, molybdenum trioxide and ferromolybdenum as the final product, as well as the most complete extraction of all associated metals.

Development of an effective technology for the processing of molybdenum ores, due primarily to the fact that such ores are significant part of the explored and exploited molybdenum deposits Republic of Uzbekistan.

II. METHODOLOGY

The main methods for processing sulfide molybdenum concentrates include: calcining the concentrate, followed by ferromolybdenum production using silicothermy methods, reduction with carbon and aluminothermy; firing followed by leaching with various solvents, for example ammonia, solutions of hydroxides, carbonates of alkali metals; roasting with lime or iron oxide binder to produce calcium molybdate or iron molybdate for the subsequent production of ferromolybdenum; sublimation firing of molybdenum trioxide; sintering with soda, as well as with sodium sulfide or sodium sulfate together with coal and subsequent aqueous leaching, precipitation of molybdenum trisulfide (applies to oxidized molybdenum ores, for example, containing wulfenites); chloride distillation together with sodium chloride or direct chlorination, (applies to polymetallic ores containing molybdenum); hydrometallurgical methods: autoclave, using nitric acid at elevated pressure and temperature, or using oxygen, as well as using alkali metal hypochlorites at ordinary temperatures and pressures. Most molybdenum concentrates contain rhenium. In industry, the raw materials for rhenium (80%) are molybdenum and copper sulfide concentrates. The remaining amount is obtained by recycling Re-Pt catalysts.

When enriching copper-molybdenum ores, Re follows Mo, which itself is often a fellow traveler of Cu. During flotation, up to 80% of Re enters the concentrate. So, the molybdenum concentrates obtained by beneficiation of copper-porphyrates contain 0.02 - 0.17% Re. Oxidative firing of sulfide molybdenum concentrates is carried out at $550 \div 650$ °C. The following apparatuses are traditionally used for firing molybdenum concentrates: muffle or chamber furnaces with manual burning of the cinder; rotary tube furnaces; multi-hearth furnaces; fluidized bed furnaces. [1,2]

Almalyksky MMC JSC is currently forced to process non-standard molybdenite concentrate (less than 30% Mo and 0.07% Re) by roasting in tube furnaces. The feedstock has a significant impact on the yield and quality of marketable products (Mo, Re). In addition, SO₂ gases generated during the firing process reduce the environmental efficiency of

production. In this regard, the transition from oxidative firing of molybdenite concentrate to oxidative firing in the presence of CaO is promising, which eliminates the formation of SO₂ and Re₂O₇:



The cinder is subject to water leaching of CaReO₄ and subsequent leaching of CaMoO₄. The optimal mode of firing the mixture (mass ratio of concentrate: CaO 1: 0.45) was identified using mathematical planning of the experiment. The concentrate with calcium additives was burned. As a result, sulfur dioxide is converted to calcium sulfate and is not released into the gas phase:



In the cinder, molybdenum and rhenium in the form of calcium molybdate and perrenate remain completely:



The temperature is 550-650 ° C, the firing duration is 60-90 minutes, with the excess content of calcium-containing additives from stoichiometrically necessary for the binding of sulfur, molybdenum and rhenium. The SO₂ content in the exhaust gases was determined by a gas analyzer of the MGL-19.3A model. The maximum permissible concentration of SO₂ in the exhaust gases is 10 mg / m³. We found that the SO₂ content in the exhaust gases is 0-2.5 mg / m³.

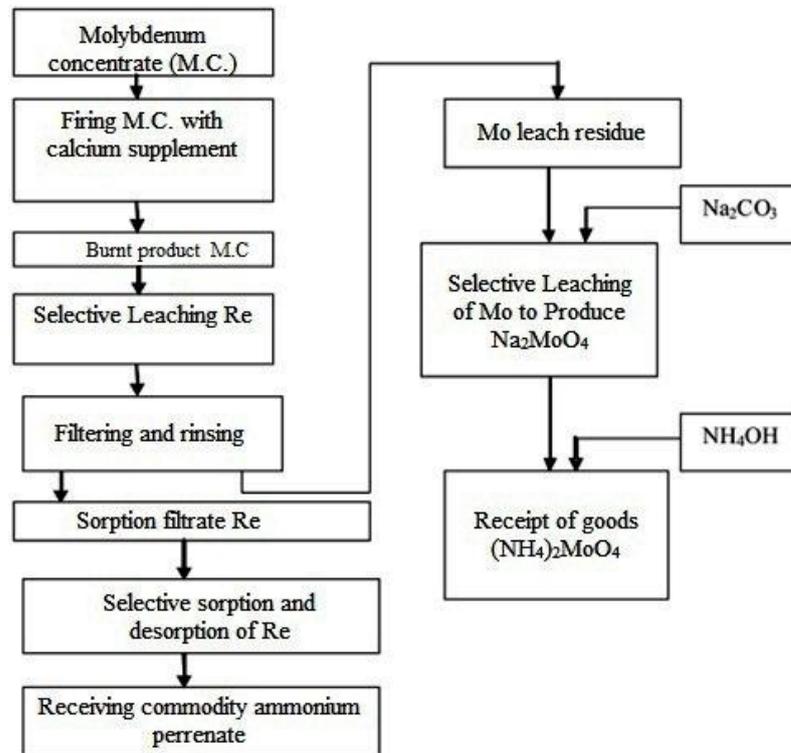


Fig. 1. Schematic diagram of the processing of non-standard molybdenite concentrates

III. EXPERIMENTAL RESULTS

The existing technology for the processing of molybdenite concentrates at JSC Almalyksky MMC does not allow the complete extraction of rhenium and is environmentally inefficient. Not more than 50-60% Re and 80-90% Mo are recovered in commercial products. The implementation of this proposed technology will provide: simplification of the dust and gas collection system; improving the environmental efficiency of production, as well as lead to an increase in metal recovery.

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