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The mechanism of thermal decomposition of oxidized nickel ore from the Kulikovskoye deposit in air

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Abstract

The object of the research is oxidized nickel ores from the Kulikovskoye deposit (Southern Urals) – non-conforming nickel-containing raw materials. The work is devoted to the study of chemical and phase composition to substantiate the choice of the method of processing this material in order to obtain valuable inorganic substances in demand in the chemical and metallurgical industries: oxide and (or) magnesium nitrate, iron and nickel containing concentrates, silicon dioxide. The chemical composition of ore demonstrating the feasibility of developing a technology for its complex processing is presented. X-ray phase analysis showed the presence of silicates of the serpentine group (lizardite-1M and lizardite-1T) and the group of spinelids (magnesioferrite) in the oxidized nickel ores of the Kulikovskoye deposit. A literary analysis suggested the presence of other hydrosilicates (antigorite, chrysotile, nimite, talc, revdinskite, clinochlore, etc.). IR spectroscopic analysis was performed to confirm the phase composition. A thermogravimetric analysis was performed, which makes it possible to determine the conditions for the preliminary preparation of ground raw materials. To determine the mechanism of thermal decomposition of ore in air, intermediate products were obtained at temperatures of 600, 700 and 900 °C. According to X-ray diffraction, IR and Raman spectroscopic analyzes, at 600 °C, the removal of OH groups, water molecules and the destruction of the crystal lattices that make up the mineral ore with the formation of oxides (FeO, SiO_2, MgO) begins. At 700 °C, island silicates are formed: forsterite Mg_2SiO_4, larnite Ca_2SiO_4. At 900 °C, the interaction between silicates continues with the complication of the composition of functional groups. Based on the described properties of minerals and previous work on the hydrometallurgical technology of processing oxidized nickel ores and metal-containing silicate raw materials in order to obtain inorganic substances, nitric acid is proposed as a leaching agent.

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