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Thermodynamic modeling of phase formation during sintering of wolframite concentrate with alkali metal carbonates

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Abstract

The quality of the wolframite concentrates is deteriorated due to the increased content of copper, molybdenum and iron in the form of sulfates, as well as silica in the form of quartz. Preliminary roasting of raw materials allows to reduce the sulfur content below 1% and convert the metal sulfides to oxides.

Thermodynamic modeling of the sintering of roasted product of low-grade wolframite concentrate (Kalgutinskoe deposit) with alkali metal carbonates was carried out using the software complex HSC Chemistry 6.12. The proportions of the coexisting phases in the temperature range 273-1273 K were quantitatively estimated. The degree of transition of elements to the target products $Na(K)_2WO_4$ was established. At the same time, stoichiometric amounts of Na_2CO_3 and K_2CO_3 were used. It was shown that the degree of transition of tungsten from $Fe_xMn_{1-x}WO_4$ to K_2WO_4 exceeds that for Na_2WO_4. A complete transition of tungsten to K_2WO_4 was achieved when using K_2CO_3 in an amount of 110% of the stoichiometrically required amount, compared to 170% for Na_2CO_3. The higher contents of SiO_2, Al_2O_3, $CuMoO_4$ and $FeMoO_4$ in the raw material reduce the degree of transition of $Fe_xMn_{1-x}WO_4$ to $Na(K)_2WO_4$. It was found that the use of K_2CO_3 instead of Na_2CO_3 leads to a decrease in the likelihood of the development of side reactions of the formation of alkali metal silicates. The decrease in the temperature of the model system leads to a decrease in the proportion of sodium silicates (potassium) in the products of sintering. To reduce the $Na(K)_2SiO_3$ content, it is necessary to slowly cool the concentrate sintering product with sodium (potassium) carbonates.

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