OPTIMIZATION OF MODES OF THE ELECTRIC DISCHARGE GRINDING OF QUARTZ RAW

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One of the tasks of the technology for obtaining quartz concentrates is the grinding of quartz raw to a fraction of 100–300 μm [1]. Traditionally, mechanical crushing, thermal crushing (thermal softening) and abrasion are used for these purposes. As an alternative, an electric discharge grinding method is considered [1], in which the working tool is a channel of a high-current discharge in water, initiated by a high-voltage pulse. With this method, there are reasonable prerequisites for minimizing contamination and obtaining a relatively narrow fractional distribution of quartz concentrate.

In this work, various modes of operation of electric discharge grinding of quartz raw were studied in order to increase the yield of a fraction of 100–300 μm. The experiments were performed at a pulse repetition rate of 5 Hz on three submicrosecond repetitively pulsed generators with a high-voltage energy storage capacity of 8, 15, and 50 nF and an output voltage of 90 to 280 kV. East Sayan quartzite with an initial size of ~25 mm was used as the initial raw material. Table 1 shows the fractional distribution of the crushing products for modes characterized by an approximately equal total energy input. The maximum fraction yield of 100–250 μm was obtained at the level of 40% for the generator with a storage capacity of 8 nF and a charging voltage of 200 kV (mode 2 in Table 1). The yield of the overgrinding product is less than 21% in this mode. It is shown that the preliminary thermal crushing of the material is not required for effective electric discharge grinding of quartzites (mode 1 and 2 in Table 1).

Table 1. Comparison of different mode of operation of electric discharge grinding of quartz in a series of 1300 pulses.

	$C_{storage}$, nF	U_{charge}, kV	$E_{storage}$, J	I_{max}, kA	$T_{current}/4$, ns	Thermal crushing	Fraction 100–250 μm, %	Overgrinding, %
1	8	160	160	4.2	260	yes	42	25
2	8	200	160	4.2	260	no	40	21
3	15.4	160	197	9.6	370	no	36	28
4	49.9	90	202	26	450	no	7	6

A comparative analysis of the chemical and structural composition of the quartz raw and quartz concentrate with a fraction of 100-300 μm obtained both by usual mechanical abrasion and electric discharge grinding (mode 2 from Table 1) was performed. Microscopic studies on an OLIMPUS BX-51 optical microscope in transmitted light showed that quartz aggregates obtained by mechanical abrasion contain a large amount of fluid inclusions, while no fluid inclusions were found in grains obtained by electric discharge grinding.

REFERENCES

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