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LABORATORY PRODUCTION OF HIGH PURITY QUARTZ FROM SPRUCE PINE MICA/CLAY TAILINGS AND OTHER SPRUCE PINE AREA SAMPLES

by

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ABSTRACT

Laboratory flotation tests were conducted to produce high purity (quintus) quartz from mica/clay tailings from Spruce Pine, North Carolina. Two other hand picked samples from another area near Spruce Pine were also tested. Testing was successful on all three samples and 12.5 pounds of product were produced from the mica/clay tailings as feed for calcination and leaching tests to produce ultra high purity (iota) quartz.

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Laboratory Nos. 5402, 5404, 5405 Notebook No. 613

BACKGROUND

Two operations near Spruce Pine, North Carolina commercially produce high purity quartz. Several quartz deposits in this area show very low levels of impurities within the quartz crystals. This is true in some cases despite the quartz occurrence in close assemblage with other minerals, such as mica, clays and feldspars.

OBJECTIVE

The objective of this investigation was to produce high purity (quintus) quartz from three Spruce Pine area samples. If this could be accomplished, a larger amount of product (say 10 pounds) would be generated for calcination and leaching tests to produce ultra high purity (iota) quartz.

SAMPLES

The primary sample (5402) was a tailing from a mica/clay producer in the Spruce Pine area. Two other samples were later added to the program. Both were hand picked from different areas and brought to the Minerals Research Laboratory. Sample 5404 was a hand picked sample of +6 inch white quartz from a different area. Sample 5405 was similar to 5404 except it was a much darker color, a nearly translucent gray-black. Sample 5402 was fine enough to process directly. Samples 5404 and 5405 were crushed to -6 mesh.

PROCEDURES

The details of reagent dosages, conditioning times, etc., are given on the flotation test data sheet at the end of this report. Basically, the procedure is the same as that used by R. M. Lewis (Notebook 511) on a different quartz material.

First the ore is screened on 50 mesh (U. S.). The oversize is ground until very little +50 mesh remains. The combined -50 mesh feed is subjected to magnetic separation, mica flotation, iron flotation and feldspar flotation, in that order. These processing steps are then repeated, starting with magnetic separation, to scavenge the last of the impurities from the quartz product.

RESULTS

The weight recoveries of the various products from the three feed samples are shown on the flotation data sheet attached. The mica/clay waste had a significant amount of oversize, most of which was coarse mica which was not ground further. Both the hand picked quartz samples gave higher quartz weight recovery, primarily due to the large amounts of mica and feldspar present in the mica/clay tailing.

Chemical analyses of the final quartz products are shown in Table I, along with a typical specification for high purity quartz. The mica/clay tailing (5402) is well within desired limits, except for the iron content. If this iron was introduced as a result of grinding in the stainless steel rod mill, calcining and leaching will effectively remove it. If it is present as particulates that somehow were not recovered in magnetic separation or iron flotation, leaching may or may not decrease it to the 2 ppm level needed for ultra high purity quartz.

The final quartz products from samples 5404 and 5405 were very high quality. For most elements, these materials came close to meeting the specifications for ultra high purity quartz. Leaching tests can determine if these impurities are inherent in the crystal structure or if they are present as discrete species which can be removed.

SUMMARY AND RECOMMENDATIONS

1. Sample 5402 met the specifications for high purity quartz after flotation, except for a slightly high iron content, which may have been picked up in grinding.
2. Samples 5404 and 5405 easily met the specifications for high purity quartz after processing. Both samples came close to

specifications for ultra high purity quartz. The very dark 5405 material had a slightly higher alumina content, but was otherwise little different from the white 5404 material.

3. Leaching and calcination tests should be conducted to determine if ultra high purity specifications can be met by any of these quartz products.

NORTH CAROLINA STATE MINERALS RESEARCH LABORATORY

ORE DRESSING TEST DATA

Lab. No. 5402, 5404, 5405 Test No. 1 - 3

Operator ______ Date 2/23-26/88

Object of Test Produce High Purity Quartz

	5402	5404	5405
	Wt.%	Wt.%	Wt.%
Oversize	3.6	0.9	0.6
Rougher Mags.	5.7	2.5	3.1
Rougher Mica Float	25.4	4.4	8.4
Rougher Iron Float	3.8	8.8	9.0
Rougher Spar Float	9.2	1.5	2.5
Scavenger Mags	2.4	2.7	3.9
Scav. Mica Float	2.1	2.4	1.4
Scav. Iron Float	3.3	3.5	2.8
Scav. Spar Float	1.9	2.6	1.5
Final Quartz Prod.	42.6	70.7	66.8

Conditions — Reagents (lbs per ton)

	Process	Min. Time	% Solids	pH	HM-70	Pine Oil	H_2SO_4	HF	Armac T	#2 Fuel Oil
1	Screen +50 M									
2	Rod Mill +50 M	*	50							
3	Deslime 150 M 2X									
4	Mag. Sep. 3X									
5	Scrub	10	60							
6	Deslime 150 M 2X									
7	Condition	5	60	2.3			0.5**			0.2
8	Float Mica			2.4		0.07			1.0	
9	Condition	5	60	2.4	2.0		0.5			
10	Float Iron			2.5		0.07				
11	Condition	5	60	2.2				2.5		
12	Float Spar			2.3		0.07			1.0	
13	Repeat 4-12									

Remarks:

*Grind Time: 5402 - 7 min., 5404 - 12 min., 5405 - 11 min.

**Both sulfuric acid additions were decreased to 0.3 lbs./ton for the scavenger floats. Same pH as shown.

TABLE I

CHEMICAL ANALYSIS OF QUARTZ PRODUCTS

	TYPICAL SPECIFICATION ppm	5402 ppm	5404 ppm	5405 ppm
Fe_2O_3	10-15	22.1	2.82	3.35
Al_2O_3	200-300	95.7	33.7	62.0
Na_2O	50-70	22.8	3.40	4.18
K_2O	30-40	11.8	2.43	2.41
CaO	20-30	5.25	2.55	3.90
MgO	-	3.11	≈0.1	≈0.1
Li_2O	-	<3.3	<3.3	<3.3