FLOTATION OF COPPER AND NICKEL SULFIDES FROM TALCOSE BEARING ORES

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Notice: The portion of the term of this patent subsequent to June 6, 1989, has been disclaimed.

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ABSTRACT
A method for the flotation of nickel and copper sulphide minerals from talcose bearing ores using an alkaline circuit in which at least one of the alkaline reagents is soda ash or ammonium hydroxide and following conditioning of the pulp with a collecting agent of the xanthate family to activate the nickel and copper sulphide materials, the pulp is conditioned with a flocculating agent to depress the host rock minerals and in which following flotation the rougher concentrate is further conditioned with a dispersant and a flocculant prior to the first cleaner float.

3 Claims, No Drawings
FLOTATION OF COPPER AND NICKEL SULFIDES FROM TALCSE BEARING ORES

RELATED APPLICATIONS

This application is a continuation-in-part of application Ser. No. 873,911, filed Nov. 3, 1969, which in turn is a continuation-in-part of application Ser. No. 727,268, filed May 7, 1968, now U. S. Pat. No. 3,596,838.

My invention relates to the flotation of nickel and copper sulphide minerals from talcose bearing ores. Ores of the aforementioned minerals which contain substantial amounts of talc had heretofore been particularly resistant to economic treatment through flotation as the finely divided talcose materials have interfered with the differential activation and flotation of the minerals.

I have found that in using an alkaline circuit wherein at least one of the alkaline reagents is soda ash or ammonium hydroxide, nickel and copper sulphide minerals may be successfully floated from ores containing high percentages of talcose type minerals which normally seriously interfere with the obtaining of an economic grade of recovery and result in poor recoveries of the nickel and copper.

GENERAL DESCRIPTION OF INVENTION

According to my invention an alkaline pulp wherein the ore has been reduced to a suitable size of subdivision for flotation is produced by wet grinding the ore in the presence of alkaline reagents consisting at least in part of soda ash or ammonium hydroxide. Preferably, copper sulphate is also present as an activator for the nickel sulphide minerals. Alternatively, the pulp may be produced by grinding the ore in the absence of reagents and then subjecting the resulting pulp to conditioning in the presence of the aforementioned alkaline reagents, preferably in the presence of copper sulphate. Suitably, the pH of the pulp is maintained within the range of 8 to 10.5 throughout the process.

The pulp is then conditioned with a suitable collecting agent of the xanthate family (normally Potassium Amyl Xanthate) until the nickel and copper minerals are fully activated, following which a flocculating agent is added together with a frothing agent such as pine oil and following the conditioning period in the presence of these reagents the pulp is subjected to a rougher flotation. A rougher concentrate is then repulped, a dispersant or flocculant is added, and following a further conditioning period in the presence of these reagents, the pulp is subjected to a cleaner float.

As will be apparent from the detailed examples which follow, the process of my invention as described generally results in the satisfactory depression of the talcose materials to produce a first cleaner concentrate of remarkably good grade with excellent recovery of both nickel and copper minerals.

EXAMPLES OF THE INVENTION

In the following examples the nickel copper ore used contained a high percentage of talc, (in excess of 30 percent) and also a high percentage of pyrrhotite, (approximately 30 percent) conventional metallurgical circuits resulted in low grade concentrates which were uneconomical for shipment to a smelter. The maximum grade concentrate produced was approximately 2.5 percent nickel. The head value of the ore was 1.15 percent nickel and 0.36 percent copper.

Except where noted, the following circuit was used:

Stage I  Grinding: Time 40'-1. Reagents to
Mill: sodium Carbonate,
Ammonium Hydroxide,
Copper Sulphate.
Conditioning: Time 20'.
Stage II  Reagents added Potassium
Amyl Xanthate
Conditioning: Time 5'-s. Reagent
added, flocculating agent and
frother
Rougher flotation:
Time 5'.
Stage III  Conditioning: Time 1 to 10'-s
rougher concentrate with
added either dispersant or
flocculant
First cleaner float:
To clean-up.

The following table shows the effect of the use of flocculants in my new circuit wherein excellent rejection of the talcose and other host rock minerals may be obtained prior to undertaking final up-grading of the ore.

In the table I have combined the rougher and first cleaner tailings as I have found it desirable to use at least one stage of flocculating prior to the rougher float, and further dispersion or flocculation of the rougher concentrate prior to the first cleaner float. If this second stage is not used, too much talc or host rock minerals are carried beyond the first cleaner, where-in it tends to produce a much lower final grade of concentrate. In addition, if too high a concentration of flocculant is used ahead of the rougher float to reject practically all of the talcose minerals in the rougher float, recovery of the nickel and copper minerals will suffer. My optimum circuit therefore requires at least one stage of dispersion or flocculation prior to the rougher float and at least one stage of dispersion or flocculation following the rougher float.

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Percent Cu</th>
<th>Percent Ni</th>
<th>Percent wt</th>
<th>NaCO₃</th>
<th>NH₄OH</th>
<th>CaSO₄</th>
<th>CuSO₄</th>
<th>25</th>
<th>Na₂S</th>
<th>Gum</th>
</tr>
</thead>
<tbody>
<tr>
<td>134......</td>
<td>0.02</td>
<td>0.086</td>
<td>0.013</td>
<td>Stage I 11.25...</td>
<td>Stage I 1.025...</td>
<td>Stage I 0.125...</td>
<td>Stage II 0.125...</td>
<td>Stage II 0.125...</td>
<td>Stage I 0.78...</td>
<td>Stage IV 0.075...</td>
</tr>
<tr>
<td>126......</td>
<td>0.026</td>
<td>0.167</td>
<td>0.023</td>
<td>0...</td>
<td>0...</td>
<td>0...</td>
<td>0...</td>
<td>0...</td>
<td>0...</td>
<td>0...</td>
</tr>
<tr>
<td>129......</td>
<td>0.022</td>
<td>0.058</td>
<td>0.021</td>
<td>0...</td>
<td>0...</td>
<td>0...</td>
<td>0...</td>
<td>0...</td>
<td>0...</td>
<td>0...</td>
</tr>
</tbody>
</table>

pH—Rougher flotation pH approximately 10.0 in all tests except where noted.

It will be noted that where the gum is used in stage I and stage IV, test 134, a lower talc and host rock rejection is obtained together with lower losses in nickel. Test 129 shows the optimum use of two stages of flocculation wherein the flocculant is added in stage III and again added in stage IV.

Test 126 gave interesting results considering no activator for the nickel sulphide minerals was used, that is copper sulphate. In this test a prolonged conditioning
time in stage II was used, that is 30's, instead of the normal 20's in the other tests. The flocculant was added ahead of the rougher flotation without any previous dispersion and gave acceptable tacle and host rock rejection with a reasonable tailings loss considering that no copper sulphate was used to pre-activate the nickel sulphide minerals. Prior to the first cleaner float in Stage IV, small amounts of both flocculant and dispersant were used.

What I claim as my invention is:

1. A process for the flotation of nickel and copper sulphide minerals from talcose bearing ores comprising producing an alkaline pulp of the ore in a suitable state of subdivision for flotation wherein at least one alkaline reagent present is soda ash or ammonium hydroxide and the pH is within the range of from about 8 to about 10.5, conditioning the resultant pulp with a collecting agent of the xanthate family until the nickel and copper minerals are activated, adding a flocculating agent for the talcose host rock materials together with a frother and conditioning the pulp to depress the talcose host rock materials, subjecting the thus produced pulp to froth flotation to produce a rougher concentrate, repulping the rougher concentrate with the addition of a further reagent selected from the group consisting of dispersants and flocculants for the talcose host rock materials and conditioning the thus produced pulp to further depress the talcose host rock materials, and subjecting the thus produced pulp to a cleaner float to produce a first cleaner concentrate relatively rich in nickel and copper sulphide minerals and relatively poor in talcose host rock ingredients.

2. A process for the flotation of nickel and copper sulphide minerals from talcose bearing ores comprising wet grinding the ore to produce an alkaline pulp thereof in a suitable state of subdivision for flotation wherein at least one alkaline reagent present is soda ash or ammonium hydroxide and the pH is within the range of from about 8 to 10.5; conditioning said pulp with a collecting agent of the xanthate family in the presence of a flocculating agent for the talcose host rock materials to activate the nickel and copper minerals and depress the talcose host rock materials; further conditioning said pulp with a frother and subjecting the same to froth flotation to produce a rougher concentrate; repulping the rougher concentrate with the addition of further flocculating agent for the talcose host rock materials and conditioning the thus produced pulp to further depress the talcose host rock materials, and subjecting the thus produced pulp to a cleaner float to produce a first cleaner concentrate relatively rich in nickel and copper sulphide minerals and relatively poor in talcose host rock ingredients.

3. A process as claimed in claim 1 wherein the reagent selected from the group consisting of dispersing agents and flocculating agents for the talcose host rock materials after the rougher concentrate is repulped is a dispersing agent for the talcose host rock materials.