MOLYBDENUM DISULFIDE FLOTATION ANTIFOAM

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Field of Search 209/166, 167, 252/61, 321, 252/319

References Cited

UNITED STATES PATENTS

2,259,420 10/1941 Mills 209/166
2,312,466 3/1943 Erickson 209/166
2,362,432 11/1944 Cuhn 209/166
2,664,199 12/1953 Barker 209/167
2,668,150 2/1954 Luvissi 252/321
3,313,412 4/1967 Bloom 209/167

FOREIGN PATENTS OR APPLICATIONS

168,212 5/1957 Australia 209/166
1,482,821 4/1967 France 252/61

ABSTRACT

An antifoam and process for the separation of molybdenum values associated with predominantly copper ores of the sulfide type. The antifoam, which is primarily directed to laundering or cleaning stages in the moly cycle, consists of a utilization of 1–60 ppm of a polyoxyethylene glycol ester in a hydrocarbon diluent per ton of ore. The oxyethylene fraction has a value of about 100–2,000 and an optimum value of 400, and the fatty acid fraction is selected from C_{14} – C_{38} acids. A preferred antifoam is polyethylene glycol 400 dioleate (P.E.G. 400 dioleate) in kerosene or isoparaffin oil as the diluent. HLB values for the P.E.G. antifoam range from 5–12 with a preferred value of 5–10 for the dioleate.

5 Claims, No Drawings
The present invention relates to an antifoam and process specifically utilized in the separation of molybdenite or molybdenum sulfide from predominantly copper ores of the sulfide type. The separation of molybdenum quantities from copper in mixtures offers commercial advantages where originally the production was directed to the recovery only of copper values. In this process in the molybdenite cycle, there occurs one or more cleaner or launderer steps which are set out by example graphically in the figures of U.S. Pat. No. 2,664,199 Barker et al.

The recovery of the molybdenite involves the depression of copper which is usually achieved by the use of a ferricyanide reagent or utilization of the inorganics exemplified by the Nokes reagent of P, As, or Sb, divalent S and an inorganic cation and commonly using \( \text{P} \text{S}_4^2- \text{NaOH} \); see U.S. Pat. No. 2,492,936 Nokes et al. Modified Nokes reagents have been utilized as for example U.S. Pat. No. 2,957,576 Henderson (Anaconda); U.S. Pat. No. 3,375,924 Corbett et al. (Miami Copper), the latter raises the pH of the usual Nokes to at least 11.4; and U.S. Pat. No. 3,435,952 Corbett (Miami Copper). Examples of additional methods of floating the molybdenite by depressing the copper are set out in U.S. Pat. No. 3,351,193 Martinez (American Cyanamid) and other copper depressants are described post.

In the so-called cleaning or launderer steps of the process for recovering molybdenite, it has been found that an abnormal or unusual amount of foam occurs which vitiate some of the commercial advantages of the process and to obviate this foam this invention adds 1–60 ppm per ton of ore or a preferred amount of 40–50 ppm of a polyethylene glycol mono- or di-ester wherein the oxyethylene or ethoxy repeating unit has a value of from about 100 to 2,000. The acid fraction may be selected from fatty acids containing 14–22 carbon atoms, such as oleic acid, stearic acid, palmitic acid, ricinoleic acid, lauric acid, myristic acid, ceroatic acid, and linoleic acid. A most preferred ester is the di-ester of polyethylene glycol having a molecular weight of about 400 (P.E.G. 400). Operable P.E.G. esters have been found to have an HLB value (Hydrophilic-Lipophilic Balance) of 5–12. From a consideration of the fact that the HLB scale is from 1–20 with the values over 10 indicating greater hydrophilic attraction, the specificity of the invention is noted. A summary of values of surfactants as in emulsions is given in the Encyclopedia of Chemical Technology II, Volume 8, pages 128–130. The following values are noted at 129 of ECT and also from McCutcheon’s Detergents and Emulsifiers, 1972 Annual:

<table>
<thead>
<tr>
<th>P.E.G.</th>
<th>HLB</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 monooleate</td>
<td>11.4</td>
</tr>
<tr>
<td>400 monostearate</td>
<td>11.6</td>
</tr>
<tr>
<td>100 monoricinoleate</td>
<td>5.0</td>
</tr>
<tr>
<td>200 dilaurate</td>
<td>6.2</td>
</tr>
<tr>
<td>400 dioleate</td>
<td>7.2</td>
</tr>
<tr>
<td>100 monolaurate</td>
<td>7.4</td>
</tr>
<tr>
<td>1500 dioleate</td>
<td>8.0</td>
</tr>
<tr>
<td>600 dioleate</td>
<td>10.0</td>
</tr>
</tbody>
</table>
No. 6 cleaner bank. Typical reagents utilized in the moly circuit are:

a. sodium hypochlorite to render the xanthate ion inactive
b. sulfuric acid pH control
c. potassium ferricyanide to depress the copper
d. antifoam

In the utilization of this, the tailings from each step are recirculated upstream in the previous step of the circuit for maximum moly recovery except in the case of the rougher and second scavenger tailings which go to a final copper concentrate thickener. The feed entering the moly circuit is approximately 5 percent solids.

It is in the laundersing or cleaning banks where the present polyoxyethylene glycol esters are utilized to suppress foam. In the subsequent molybdenum flotation steps sufficient copper depressants may be utilized such as alkali sulfides, cyanides, cuprocyanides, ferrocyanides, or ferricyanides. It has been found that the utilization of the present antifoams in the cleaning stages assists in reducing the amount of copper passing through to the final recovery of molybdenum sulfide, and it is for this reason that multiple cleaning or launderer stages are utilized.

EXAMPLE I

In a molybdenum flotation process utilizing in the molybdenum cycle two stages of launderer, an antifoam composition consisting of 20 parts by weight P.E.G. 400 dioleate and 80 parts by weight of deodorized kerosene in a concentration of 250 ppm was introduced into each launderer stage. Visual inspection at intervals during the 30-day period showed that there was a significant reduction in foam concomitant with a more even visual surface in the launderer. Recovery downstream of molybdenite showed that the percent copper in the molybdenum flotation stage was about 1 percent through the entire period. It is noted that increasing levels of copper in the froth are indicated by an increase in a greenish tint, whereas a rich moly froth is indicated by a brighter gray luster.

EXAMPLE II

In a moly sulfide cycle or circuit following the flotation of the copper values, a circuit was utilized consisting of one rougher bank, two scavenger banks, and six cleaner banks. The final product molybdenum is the froth from No. 6 cleaner. In the process, sodium hypochlorite was utilized to render the xanthate ion inactive which had been previously utilized for copper recovery and potassium ferricyanide was utilized to depress the copper in this moly cycle. Additionally, sulfuric acid was utilized for pH control and 50 ppm of polyoxyethylene 400 dioleate was added as an antifoam in the circuit. The result was a decrease in the amount of copper recovered in the latter stages evidenced by the visual appearance of a gray color substituted for a previous greenish color in the cleaning or launderer stage of a surfeit of foam.

The embodiments of this invention in which an exclusive property or privilege is claimed are defined as follows:

1. In the recovery process of molybdenite from associated copper values froth flotation where the copper values are depressed, the step of adding to the launderer stage of the molybdenum recovery cycle an antifoam consisting of about 1–60 ppm per ton of ore of a polyoxyethylene glycol ester wherein the oxyethylene repeating unit has a molecular weight of from about 100–2,000 and the acid fraction is selected from fatty acids containing 14–22 carbon atoms and a hydrocarbon diluent and subsequently floating off the molybdenite.

2. In the process according to claim 1, the step of adding an antifoam consisting of about 40–50 ppm of polyoxyethylene glycol 400 dioleate and kerosene as a hydrocarbon diluent.

3. In the process according to claim 1, the step of adding an antifoam consisting of about 40–50 ppm of polyoxyethylene glycol 400 dioleate and isoparaffin oil as a hydrocarbon diluent.

4. In the process according to claim 1, the step of adding an antifoam consisting of a polyoxyethylene ester having an HLB range of from 5–12.

5. In the process according to claim 1, the step of adding an antifoam consisting of about 40–50 ppm of a polyoxyethylene oleate ester having an HLB value of from 5–10.

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