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METHOD OF SEPARATING LEAD AND CADMIUM FROM ZINC ORES

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My invention relates to a process for separating lead and cadmium from zinc-containing ores or concentrates by roasting the ore or concentrate on a sintering machine while passing a blast of air downwardly therethrough.

In the roasting of ores or ore concentrates containing zinc, lead and cadmium compounds such as sulphides of these metals it is customary to spread the ore or concentrate on the traveling grate of a sintering machine, then ignite the ore and burn or roast it by a down-draft so that the lead and cadmium are volatilized while the zinc content of the ore remains as a residue. A suitable chloride, such as sodium chloride, may be added to the ore or ore concentrate to aid in the volatilization of the lead and cadmium. The ore or concentrate is sufficiently porous to permit the passage of air, having pores of a magnitude of about one-thirty second of an inch or less through which the air of the blast passes. One difficulty encountered in the operation of this process is that a very considerable quantity of lead and cadmium remains in the residue, although the temperatures employed may be sufficient to completely volatilize the lead and cadmium compounds.

This difficulty is avoided in my invention by which the lead and cadmium may be completely or almost completely removed, leaving only a very minute quantity of these metals in the residue remaining after the roasting.

In my invention I support the bed of ore or concentrate being roasted in such a manner that the removal of heat by conduction from the bottom surface of the bed is reduced to a very small or negligible quantity and at the same time provide relatively large or wide passageways for the gases carrying the lead and cadmium compound or fume. By treating the bed of ore in this manner the maximum roasting temperature may be carried to the lower surface of the bed thereby keeping the lead and cadmium in the vapor state or phase rather than as a suspended fume until it is entirely free from the roasting bed. Relatively coarse passages are provided for the gases after they have left the roasting bed so that as they cool the lead and cadmium which condenses as fume is not brought into intimate contact with surfaces upon which it may condense and collect. For this purpose I provide between the metallic supporting pallets of the sintering machine and the material being roasted a layer of low heat conductivity and of large passageways for the gases of combustion. This layer may be a top covering attached to the pallets, as for example, a heat resistant ceramic material having sufficiently large pores, or it may be a coarsely crushed layer of heat resistant material of low conductivity such as the sintered residue formed in a previous roasting operation and which had been crushed to such a size as to give the proper air passages.

The use of this material has the advantage that it may be collected along with the sintered product without the necessity for separating the two. This product differs from the lower layer of the bed of ore or concentrate being roasted in that it has much larger air passages.

Consequently, although its temperature may be much lower than that of the roasting bed and therefore such that volatilized lead and cadmium will condense as a suspended fume, the suspended particles of fume thus formed pass freely through the intervening supporting bed and leave it substantially free from cadmium and lead. As a result, the roasting temperature may extend throughout every part of the bed having the small pores of the concentrate being roasted, to free these pores of the lead and zinc content. The average amount of lead and cadmium remaining in the roasted ore is thereby reduced to a negligible quantity. Another difference is that whereas a slight deposition of lead and cadmium fume in the narrow passages of the roasting bed causes a proportionately very great narrowing of these passageways and thus aggravates the tendency to deposit the fume, any deposition of such fume on the relatively coarse passages of the insulating supporting layer has a negligible effect so far as narrowing the passage areas is concerned.

As an example of the process, a layer of coarsely crushed sintered material of one-quarter inch to one-half inch or one-quarter inch to three-quarter inch size is provided as a covering layer for the pallets of the sintering machine. The material crushed to this size provides voids or passages approximating about one-eighth inch to one-sixth inch in diameter. On this grate covering there is placed a layer of ore or ore concentrate having passages of a maximum dimension up to about one-thirty-second of an inch. The ore is then ignited at the top surface, some fuel being supplied if necessary, and burned with a down-draft so that a zone of combustion of maximum temperatures passes from the top to the bottom layer of the ore bed. This combustion zone is sufficiently high in temperature to volatilize the lead and cadmium, continuously driving it into the lower cooler areas where any de-

posited fume is again vaporized and driven downwardly until it reaches the lower surface of the ore bed. Thereupon it passes into the relatively coarse passages through which it is rapidly carried without undue loss of temperature or deposition of fume.

By the above process a concentration of lead and cadmium in the lower part of the ore bed being roasted is avoided and a residue of substantially uniform composition is obtained. For example, a sintered bed roasted in the manner heretofore used had an average lead content of 0.15% and an average cadmium content of 0.015%. The concentrations of lead and cadmium, respectively, in the lower layers of the bed were as high as 0.25 and 0.175 indicating a very rapid increase in lead and cadmium content toward the lower surface. In contrast, a sintered bed formed by my process had an average lead content of 0.02% and an average cadmium content of 0.002% and the concentration of lead and cadmium at the bottom layer were respectively 0.025% and 0.003%. This percentage is not substantially increased when this sintered material is coarsely crushed and used as a supporting layer for a subsequent bed to be roasted. Consequently, the fresh sinter and that used as insulating supporting layer may be commingled in the final product.

Through my invention, therefore, I have provided a process whereby the lead and cadmium may be separated substantially completely from zinc by a relatively simple roasting operation.

What I claim is:

1. In the blast sintering of zinciferous materials containing lead and cadmium in a downdraft sintering machine, the method of preventing the concentration of the lead and cadmium in the lower portion of the sintering charge which comprises providing air passages in the lower portion of the charge about four times as large on the average as the air passages in the upper portion of the charge.

2. In the blast sintering of zinciferous materials containing lead and cadmium in a downdraft sintering machine, the method of preventing concentration of the lead and cadmium in the lower portion of the sintering charge which comprises providing air passages in the bottom of said charge ranging from ⅛ to ⅙ inch, the diameter of the air passages through the upper portion of the charge having a maximum of about ¼ of an inch.

3. In the blast sintering of zinciferous materials containing lead and cadmium in a downdraft sintering machine, a protective hearth layer consisting of material of relatively low heat conductivity and of a particle size adapted to leave air passageways through the layer having diameters approximately ⅛ to ⅙ inch, and a sintering charge of said zinciferous materials overlaying said hearth layer having air passageways not exceeding about ¼ inch in diameter.

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