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ALTERNATE SOURCES OF LEAD - 23,849

VISIT TO LEAD SMELTER AND REFINERY OF THE BERS SMELTING AND REFINING COMPANY BY DU PONT PERSONNEL

Through arrangements made by Mr. G. R. Cantwell, the writer and Messrs. R. Gedd and J. Jackson of Newark, visited on November 10, 1951, the Bers Smelting and Refining Company secondaries lead smelter and refinery located at Ashland and Lewis Streets, Philadelphia, Pennsylvania, where we were met by Mr. Julian Bers, President of the subject company.

Purpose of Visit

The purpose of the visit was to discuss with Mr. Bers the nature of the raw materials used, and the products made in the refinery, and to see the metallurgical operations employed at the smelter and refinery with a view of coming to a fuller mutual understanding of how to best prepare and subsequently utilise the Bers Company lead flue dusts as a substitute for metallic lead at the Pigments Department plant in Newark, N. J. Extreme caution was exercised during the visit against any discussion in detail of the du Pont Company's process in Newark, and likewise of it items of "know-how" belonging to the Bers Company's operations.

Equipment and Source of Flue Dusts

Preliminary discussions held in Mr. Bers' office with Mr. Bers and the du Pont personnel included a statement of the purpose of the visit, and how certain impurities as sulphur, chlorine, iron andccopper are particularly deleterious to the Newark operations. Mr. Bers suggested at the outset that an immediate trip through the refinery to see the equipment, raw materials used, and products made would expedite the visit. The smelting and refining equipment consists of: three lead blast furnaces (two of which were in operation); two reverberatory furnaces (one of which was in operation); drossing kettles, a Mace sintering machine (not in operation); and storage facilities for raw materials used and products made. An extensive flue dust collection system using cyclone scrubbers was seen, and it was pointed out that the scrubbed, wet flue dusts from the reverberatory furnaces were collected in a sump apart from the

scrubbed, wet flue dusts from the blast furnaces, which are collected in another sump. Importance was attached to the feature of the separate sumps, since the sludges deposited separately are excavated by a clam-shell type bucket and stored on one common pile where they are allowed to dry by natural drainage. It is thought that the dusts from the reverberatory furnaces comprise 35% of the weight of total dusts produced (remaining 65% originating from the blast furnaces), and are lower in impurities than those from the blast furnaces. It was pointed out that raw material of high chlorine content (as T.E.L. residues from the Chambers Works) are given a water leaching and washing operation to extract chloride salts, and then fed to the blast furnaces. This means that high chloride content flue dusts originate from the blast furnaces. It is estimated that approximately 200 tons of flue dust are produced monthly (confirmed by telephone with Mr. Bers). A large pile of combined flue dusts was seen in the storage area and probably contains in the order of 500 tons of material.

Raw Material

Large piles of scrap storage batteries were seen and examined. This material is a considerable source of sulphur in the form of $PbSO_4$ from the decomposition of the cells, residual sulphuric acid present, and other adhering resinous, organic matter. Other materials pointed out were lead drosses (in the form of large buttons), and residues from the T.E.L. operations from the Chambers Works. This latter material is a considerable source of chlorine as received, and is therefore leached and washed with water to remove as much water soluble salts as possible, and after draining forms a part of the charge to the blast furnaces. Mr. Bers pointed out that it is absolutely necessary for his blast furnace operations to remove as much NaCl as possible by leaching and washing, since NaCL has a relatively low melting point (800°C.) and may run down through the charge, cooling it, with subsequent danger of freezing the charge.

Another harmful characteristic of chlorides in lead smelting is that they increase lead losses due to volatilization. It is significant of note that no lead minerals nor concentrates are smelted at the refinery. Mr. Bers stated that this fact is due in part to the lack of sintering equipment (one sintering machine available), which he might expand in the future. Universal adaptation of flotation concentration to lead ores with extreme fineness of the concentrates entails sintering as a "must" for blast furnace smelting of concentrates.

Smelting Operations

The reverberatory furnaces and blast furnaces supplement each other in operation as far as possible. It was indicated that the materials charged to the reverberatory furnaces contain less impurities than those charged to the blast furnace and which is borne out by the fact that less impurities (Fe, Cu, Cl) are expected (samples are being prepared) to be found in the flue dusts from the reverberatories. The reverberatory operation appears to be essentially one of melting (with intermittent oxidation and reduction) and was explained to be a 24-hour cycle yielding 25 tons of lead per reverberatory. The other products

from the reverberatory smelting are a slag containing essentially oxides, sulphides, sulphates and silicates of lead, and this slag is crushed and smelted in the blast furnace. The flue dust produced consists mainly of oxidized compounds of fine particle size due to the high temperature of the reverberatory gases of the order of 2500°F.

The blast furnace operation consists essentially of reducing the lead to metal (bullion) and slagging the impurities to separate them from the metal by differences in specific gravity. Thus to the lead raw materials charged to the furnace, there is added coke and limestone, and the products from the furnace are slag, matte, speiss, bullion and flue dust. When the slag contains over 2% lead, it is crushed and returned to the furnace. Mr. Bers stated that the matte and speiss are shipped to be refined elsewhere. The metallic lead is transferred to drossing kettles for refining.

Refining Operations

The impurities held in solution or suspension in the crude lead are removed in the drossing kettles by an operation known as "drossing" or oxidation by mechanical stirring of the molten lead and addition of compressed air or steam, and by the addition of sulphur. The impurities, such as antimony, arsenic, iron, zinc, and copper are slowly oxidized and rise to the surface as a dross which is skimmed off the surface by a perforated spoon. Copper may be removed as a sulphide by the addition of sulphur (brimstone) as a drossing reagent. The drosses are usually returned to the blast-furnace charge, or may also be smelted separately in a reverberatory furnace.

Summary

The flue dust from the Bers Company reverberatories appears to be a more attractive alternate source of lead to supplement metallic lead for the lead nitrate and T.B.L. operations because of expected lower impurities content. Therefore, it was requested of Mr. Bers that special samples be taken of the reverberatory flue dusts on an "as is" basis. That is, the scrubbed, wet dusts will be sampled as they go for collection to a settling sump, and will be shipped to Newark as a slurry, as it is desired that no drying operation be performed on the sample by the Bers Company.

Mr. Bers stated that a source of equal material (reverberatory flue dust, same tonnage) is being produced and could probably be obtained from a lead refinery in Boston, and in which Mr. Bers has a part interest.

Mr. Bers thought he could obtain for sale to the du Pont Company from a source outside of his company operations (source not named) a lead dross containing 45-70% lead, with a voluminous amount of coal content (small percentage on weight basis), with appreciable iron content but free from chlorine and copper. Mr. Bers did not have information as to tonnages of this dross available, but he would be glad to get this information and other pertinent data if requested of him.

As the flue dusts (reverberatory and blast furnace) are collected in separate sumps for settling, they could be stored for drainage on separate piles and shipped separately, rather than on a common pile as at present.

Mr. Bers stated that his sintering machine (Mace) was not in use due to man-power shortages, and economic factors involved.

Pig lead ingots from Bers Company are sold under the name "SCHUYKILL". "Corroding Lead" is used in the trade to describe the type of lead refined to a high degree of purity (99.94% minimum), and for many operations requiring pig lead, "corroding lead" purity is not necessary (there are six other common commercial grades of pig lead). In the manufacture of storage-battery grids, an alloy of 94% lead and 6% antimony is used, and in some new developments with storage batteries, lead is alloyed with silver and arsenic.

ENGINEERING SERVICE DIVISION

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