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PROCESS OF TREATING LEAD OR LEAD ALLOYS

William Thomas Butcher, Ilford, England, assignor to Goodlass Wall & Lead Industries Limited, London, England

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This invention provides a general method of introducing a metal A into a bath of molten lead containing a metal B, which consists in treating the bath with a flux containing a lead halide and a sulphide of the metal A, whereby an interaction takes place resulting in the replacement of metal B in the bath by the metal A, and its extraction in the flux in the form of a sulphide.

This method can be employed for refining lead alloys, by extraction therefrom of the metal B and its replacement by lead, in which case the flux used will contain a lead halide and lead sulphide. It can also be employed for introducing into molten lead an alloying ingredient, in which case the bath consists of lead and the flux of a mixture of a lead halide and a sulphide of the metal to be alloyed with the lead. Further the substitution in a lead alloy of one alloying constituent by another can be effected. Thus if a lead alloy containing copper is treated with a lead halide flux containing antimony sulphide, antimony will enter the bath and copper be extracted in the flux in the form of copper sulphide. In this instance, not only does antimony replace copper in the bath but a certain amount of lead is replaced as well. In all cases the method has the advantage that it can be carried out at relatively low temperatures of the order of 550° C.

With certain metals the process is irreversible. Thus arsenic, antimony, silver, tellurium and bismuth can be caused to replace lead or other metals in the bath by incorporating them in the flux in the form of sulphides but they cannot be removed from the bath by treating with sulphides of other metals once they are alloyed therein.

Again lithium, sodium, magnesium, aluminium, potassium, calcium, zinc, strontium and tin can all be extracted from the bath by treatment with a lead halide flux containing lead sulphide, but they cannot be introduced into the bath by incorporation of a sulphide of any of these metals in the flux.

Other metals, such as nickel, cadmium, copper and selenium can, under suitable conditions, act as either the metal A or the metal B.

It has been found that pure sulphides need not necessarily be employed but sulphide ores and residues can be used.

Some examples of how the invention can be carried into effect will now be given:—In each of the examples quoted below the lead alloy to be treated is melted in a kettle and heated to about 550° C. The lead halide with the whole or a portion of the sulphide of the metal A is then added and the whole forms a fluid layer on the surface of the metal. Mixing is then commenced and is effected by the usual means until the reaction is finished, the balance, if any, of the metallic sulphide being added meanwhile.

In some cases it is preferable to make more than one flux addition and this is specially so where preferential removal of a certain metal from the bath is aimed at.

I

1,040 parts of a lead alloy containing 0.4% magnesium were stirred with 100 parts of lead chloride and 25 parts of lead sulphide for fifteen minutes and the magnesium in the alloy was completely replaced by lead from the lead sulphide. Similar results were obtained using lithium, sodium, potassium, calcium, aluminium, strontium and zinc as the metal B in the lead. Using lead fluoride instead of lead chloride with lead sulphide similar results were obtained except that in the case of tin 64% was removed.

II

5 parts of bismuth sulphide and 50 parts of lead fluoride were added to 1000 parts of molten lead, and stirring continued for 15 minutes, when it was found that 98% of the bismuth in the flux replaced lead in the bath. Using lead chloride instead of lead fluoride in the flux, 93% of the bismuth was found in the bath.

III

1000 parts of lead containing 0.1% nickel were treated with 50 parts of lead fluoride and 25 parts lead sulphide and stirred for 20 minutes, after which 12% of the contained nickel was removed. Using antimony sulphide in place of lead sulphide the removed nickel was 48% of the total. In a case where the flux consisted of lead chloride and lead sulphide 50% of the nickel was removed.

This reaction, unlike those given in the preceding examples, is a reversible one. For example by treating molten lead (1000 parts) with a flux consisting of lead fluoride (50 parts) and nickel sulphide (5 parts), 23% of the nickel present in the flux became alloyed with the lead.

IV

1,400 parts of lead containing 0.4% strontium were treated with 50 parts of lead chloride and 10 parts of lead sulphide for 15 minutes and the whole of the strontium was removed from the metal.

V

1000 parts of lead containing 0.44% cadmium were stirred for 15 minutes with 50 parts of lead chloride and 25 parts of lead sulphide after which it was found that the whole of the cadmium was removed from the metal.

These reactions are likewise reversible. For example, using a flux consisting of 5 parts of cadmium sulphide and 50 parts of lead fluoride to treat 1000 parts of molten lead, it was found that 10% of the cadmium became alloyed with the lead.

VI

As explained above, arsenic and antimony can be introduced into but not extracted from the bath by the method according to the invention. Thus using lead fluoride as the flux, 1000 parts of molten lead were stirred for 15 minutes with 100 parts of lead fluoride and 50 parts of antimony sulphide. It was found that 50% of the antimony replaced lead in the bath.

A similar experiment, in which 1000 parts of molten lead were stirred for 15 minutes with 50 parts of lead fluoride and 10 parts of arsenic sulphide resulted in 60% of the arsenic replacing lead in the bath. On repetition using lead chloride as the flux 62% of the arsenic was found to replace lead in the bath.

VII

The following is an example of the extraction of copper from lead alloys.

1000 parts of lead containing 0.04% copper were treated with 150 parts of lead chloride and 70 parts of lead sulphide. After treatment the metal analyzed 0.0115% copper.

VIII

The following is an example of the extraction of selenium from lead alloys.

On treating 1000 parts of lead containing 0.033% selenium with 100 parts of lead chloride and 25 parts of lead sulphide and stirring for 20 minutes, 66% of the contained selenium was removed.

IX

The following are examples of the alloying of silver, tellurium and bismuth with lead.

In each case 5 parts of sulphide of the metal to be introduced were mixed with 50 parts of lead fluoride and stirred into 1000 parts of molten lead for 15 minutes. In the case of silver 30% replaced lead in the bath, while the figures for tellurium and bismuth were 99% and 98% respectively.

What I claim as my invention and desire to secure by Letters Patent is:—

1. A process of treating lead, which comprises the steps of reacting upon a bath containing molten lead with a flux, consisting of a mixture of a lead halide and a sulphide of a metal A having a less affinity for sulphur than a metal B present in the bath, thereby effecting interaction between the metal B and the said sulphide and replacement thereof in the bath by the metal A, and removing the metal B by separating the flux from the bath.

2. A process according to claim 1, in which the sulphide employed in the flux is a sulphide ore or residue.

3. A process for alloying with lead one of the metals arsenic, antimony, silver, tellurium, bismuth, which comprises the steps of treating a bath of molten lead with a flux, consisting of a mixture of a lead halide and a sulphide of one of the metals aforesaid, thereby replacing lead in the bath by the metallic constituent of the sulphide and removing the lead sulphide so formed by separating the flux from the alloy.

4. A process according to claim 3, in which the sulphide employed in the flux is an oxide ore or residue.

5. A process for removing from a lead alloy any one of the metals lithium, sodium, magnesium, aluminium, potassium, calcium, zinc, strontium, tin, which comprises the steps of treating a bath of the molten alloy with a flux, consisting of a mixture of a lead halide and lead sulphide, thereby converting the metal to be removed into a sulphide and replacing it in the bath by lead and removing the metallic sulphide so formed by separating the flux from the bath.

6. A process according to claim 5, in which the sulphide employed in the flux is a sulphide ore or residue.

7. A process of treating lead, which comprises the steps of reacting upon a bath containing molten lead with a flux, consisting of a mixture of lead chloride and a sulphide of a metal A having a less affinity for sulphur than a metal B present in the bath, thereby effecting interaction between the metal B and the said sulphide and replacement thereof in the bath by the metal A, and removing the metal B by separating the flux from the bath.

8. A process of treating lead, which comprises the steps of reacting upon a bath containing molten lead with a flux, consisting of a mixture of lead fluoride and a sulphide of a metal A having a less affinity for sulphur than a metal B present in the bath, thereby effecting interaction between the metal B and the said sulphide and replacement thereof in the bath by the metal A, and removing the metal B by separating the flux from the bath.

9. A process for alloying with lead one of the metals arsenic, antimony, silver, tellurium, bismuth, which comprises the steps of treating a bath of molten lead with a flux, consisting of a mixture of lead chloride and a sulphide of one of the metals aforesaid, thereby replacing lead in the bath by the metallic constituent of the sulphide and removing the lead sulphide so formed by separating the flux from the alloy.

10. A process for alloying with lead one of the metals arsenic, antimony, silver, tellurium, bismuth, which comprises the steps of treating a bath of molten lead with a flux, consisting of a mixture of lead fluoride and a sulphide of one of the metals aforesaid, thereby replacing lead in the bath by the metallic constituent of the sulphide and removing the lead sulphide so formed by separating the flux from the alloy.

11. A process for removing from a lead alloy any one of the metals lithium, sodium, magnesium, aluminium, potassium, calcium, zinc, strontium, tin, which comprises the steps of treating a bath of the molten alloy with a flux, consisting of a mixture of lead chloride and lead sulphide, thereby converting the metal to be removed into a sulphide and replacing it in the bath by lead and removing the metallic sulphide so formed by separating the flux from the bath.

12. A process for removing from a lead alloy any one of the metals lithium, sodium, magnesium, aluminium, potassium, calcium, zinc, strontium, tin, which comprises the steps of treating a bath of the molten alloy with a flux, consisting of a mixture of lead fluoride and lead sulphide, thereby converting the metal to be removed into a sulphide and replacing it in the bath by lead and removing the metallic sulphide so formed by separating the flux from the bath.

WILLIAM THOMAS BUTCHER.