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ANODE FOR THE ELECTROLYSIS OF COPPER SOLUTIONS.

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This invention relates to the electrometallurgy of copper and more particularly to the electrodeposition of metallic copper from solutions of its salts containing chlorides or nitrates or both such as are produced by leaching certain oxide copper ores and some Chilean ores with sulfuric acid.

It is customary to recover copper from solutions of its salts by electrodeposition using insoluble anodes and when the solutions are substantially free of chlorides and nitrates the best anode material is lead. Substantially pure or commercial low-antimonial lead is relatively cheap and easy to cast and handle, returns a good scrap value, gives a favorable voltage and is not excessively corroded when the copper solutions are substantially free of chlorides and nitrates, but when the copper solutions contain substantial quantities of chlorides or nitrates or both, anodes of pure lead or commercial low-antimonial lead are rapidly corroded. An object of the invention, therefore, is to provide anodes having the desirable properties of lead with respect to cost, workability, scrap value and voltage, but which are not objectionably corroded by copper solutions such as those referred to containing chlorides and nitrates.

We have found that certain lead-antimony-arsenic alloys are very resistant to electrolytes containing chlorides and nitrates and our invention, therefore, resides in the use of such alloys as anodes in the electrodeposition of copper from solutions thereof containing chlorides or nitrates or both.

The following tables of data of comparative tests of anodes of substantially pure lead and anodes of alloys of lead, antimony and arsenic in different proportions in the electrolysis of copper solutions containing different quantities of chlorides and nitrates illustrate the superiority of the alloys as anodes in the electrolysis of such solutions:

		I	II	III	IV	V	VI	VII
Anode	Per cent Sb	14.9	20.1	63.6	64.0	Substantially pure lead.		
	Per cent As	.6	.5	2.8	6.8			
	Per cent Pb	84.5	79.4	33.6	29.2			
Solution	Gr. Cl per liter	.15	.15	.36	.36	.15	.36	.36
	Gr. HNO_3 per liter	.60	.60	6.9	6.9	.60	6.9	6.9
Pounds of anode lost by corrosion per ton of copper deposited		1.35	.48	.00	.00	473	Anodes almost completely destroyed in 3 days.	
Duration of test—days		42	48	15	15	16		

From these tables it appears not only that the lead-antimony-arsenic-alloy anodes are much more resistant to corrosion in the electrodeposition of copper from solutions containing chlorides and nitrates but that in general the greater the chloride and nitrate content of the solutions the greater should be the antimony and arsenic content of the anodes. Further than this a definite rule for the determination of the best proportion of lead, antimony and arsenic in an anode for use with a particular electrolyte or solution cannot be formulated. The best proportions of lead, antimony and arsenic for use with a particular electrolyte must be determined by test following the general rule that the greater the chloride and nitrate content of the electrolyte the greater should be the proportions of antimony and arsenic in the anodes.

The voltages obtained by the use of the lead-antimony-arsenic alloys as anodes in the electrodeposition of copper are only slightly higher than those obtained with anodes of substantially pure lead and the cathodes do not contain any more antimony or arsenic than when pure lead anodes are used. The alloys are readily cast into anodes.

The alloys may be prepared in any suitable way. For example, commercially pure antimony may be melted first in an iron pot and the lead and arsenic added to the molten antimony in order. The resulting molten mixture is stirred, skimmed and cast into iron moulds. Or antimonial lead as it comes from the lead refineries may be melted and antimony or arsenic or both added to it to secure the desired proportions in the resulting alloy or for the electrolysis of some solutions, it may be possible to obtain a suitable anode alloy directly from the lead refineries.

The lead, antimony and arsenic contents of the alloys are capable of wide variation, say from 1 to 15 percent of arsenic and from 15 to 70 percent of antimony.

It is understood that the invention is not limited to the details of the specific examples, but is defined by the appended claims.

We claim:

1. Anodes for the electrolysis of copper solutions composed of alloys of lead, antimony and arsenic.

2. Anodes for the electrolysis of copper solutions composed of alloys of lead, antimony and arsenic containing from 1 to 15 percent of arsenic, from 15 to 70 percent of antimony and from 84 to 15 percent of lead.

In testimony whereof, we affix our signatures.

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