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PROCESS FOR THE PRODUCTION OF FERROBORON

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4 Claims. (Cl. 75—17)

The present invention relates to improvements in the production of ferroboron.

It has not hitherto been proposed to employ the alumino-thermic process—frequently used for the production of metals or alloys—for the production of ferroboron. This process is moreover, attended with certain difficulties inasmuch as mixtures of boron compounds, ferric oxide and aluminium granules or powder do not automatically react to completion and the reaction mixtures only burn through sluggishly even when aluminium-magnesium alloys are employed instead of pure aluminium, as has already been widely proposed for alumino-thermic reactions. Moreover, even in this case, no regulus is obtained, the reduced metal merely remaining in the refractory slag in the form of flakes.

The present invention aims at obtaining ferroboron without difficulty in the form of a well-defined regulus, which is practically free from aluminium, by the alumino-thermic reduction of boracite. To this end, according to the invention, a mixture of boracite and iron oxide (magnetite) is caused to react with an aluminium-magnesium alloy in the presence of an oxidising agent such as potassium chlorate.

Whilst in the case of smaller batches, it is advantageous to employ an alloy having a relatively high magnesium content (i. e. between about 30 and 60 percent of magnesium) for the reduction, it has been found with larger batches, that the use of alloys richer in aluminium produces an increase in the yield without running the risk, in the latter case, of the regulus being contaminated by any appreciable amount of aluminium. On the other hand, when using aluminium alone, the reaction proceeds only sluggishly even in the presence of considerable quantities of potassium chlorate and a part of the reduced metal remains distributed through the slag. Moreover, it is of advantage to employ a certain excess of boracite since this facilitates the production of a more mobile slag, thus permitting the regulus to be formed undisturbed. The amount of aluminium-magnesium alloy employed in carrying out the invention is advantageously so calculated that it is sufficient both for the decomposition of the potassium chlorate and for the reduction of the whole of the magnetite together with about 80 to 90 percent of the boracite.

The following comparative examples illustrate the influence of the various features of the hereindescribed process on the course of the reaction:—

Reaction mixture	Remarks
(1) 144 g. boracite 104 g. magnetite 89.7 g. Al-granules	Does not react.
(2) 144 g. boracite 104 g. magnetite 103.1 g. Al-Mg-alloy 50/50	Reaction sluggish, flakes in the slag, no regulus.
(3) 144 g. boracite 104 g. magnetite 139.7 g. Al-granules 114 g. potassium chlorate	Reaction proceeds slowly, regulus, nevertheless granules in the slag. Aluminium content of regulus: 24.7 percent; boron content of regulus: 18.3 percent. Yield: 27.4 percent (exclusive of granules).
(4) 144 g. boracite 104 g. magnetite 131.5 g. Al-Mg-alloy 90/100 87 g. potassium chlorate (35 percent)	Reaction vigorous, regulus, aluminium content of regulus: 9.6 percent; boron content of regulus: 20.4 percent; yield: 68.0 percent.
(5) 159 g. boracite (10 percent excess) 104 g. magnetite 135.4 g. Al-Mg-alloy 70/30 79 g. potassium chlorate (30 percent)	Reaction vigorous, regulus, aluminium content of regulus: 4.3 percent; boron content of regulus: 20.7 percent; yield: 39.5 percent.
(6) 166 g. boracite (15 percent excess) 104 g. magnetite 123.7 g. Al-Mg-alloy 50/50 41 g. potassium chlorate (15 percent)	Reaction vigorous, regulus, aluminium content of regulus: 0.6 percent; boron content of regulus: 19.6 percent; yield: 34.1 percent.
(7) 6.350 kg. boracite (10 percent excess) 5.550 kg. magnetite 5.700 kg. Al-Mg-alloy 90/10 3.600 kg. potassium chlorate (30 per cent)	Reaction vigorous, regulus, aluminium content of regulus: 0.44 percent; boron content of regulus: 15.40 percent; yield: 58.8 percent.

In Examples 1 to 4, the amount of the reducing agent is so calculated that it is theoretically sufficient for the complete reduction. In Examples 5 and 6, however, it is so calculated that 10 percent or 15 percent of the boracite remains unreduced. Example 7 is illustrative of the use of an alloy containing 90 percent of aluminium and 10 percent of magnesium for larger batches.

In carrying out the invention, it is also possible to replace the boracite by corresponding mixtures of the components B_2O_3, MgO and $MgCl_2$, or mixtures of boric acid with other alkaline earth oxides or chlorides.

We claim:—

1. A process for the production of reguline ferroboron which comprises causing a mixture of boracite and a reducible iron compound to react alumino-thermically with an aluminium magnesium alloy in the presence of an oxidizing agent.

2. A process for the production of reguline ferroboron which comprises causing boracite and a reducible iron compound to react alumino-thermically with an aluminium magnesium alloy in the presence of an oxidizing agent, the quantity of boron halogen compound being somewhat in excess over the stoichiometric proportion required by the aluminium magnesium alloy.

3. A process for the production of reguline ferroboron which comprises causing a mixture of boracite and ferric oxide to react alumino-thermically with an aluminium magnesium alloy in the presence of an alkali metal chlorate.

4. A process for the production of reguline ferroboron which comprises causing a mixture of boracite and iron oxide to react alumino-thermically with an alloy containing between about 10 and about 60 per cent of magnesium, the remainder being aluminium, in the presence of an oxidizing agent.

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