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Section 29

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PATENT REQUEST: STANDARD PATENT/PATENT OF ADDITION

We, being the person identified below as the Applicant, request the grant of a patent to the person identified below as the Nominated Person, for an invention described in the accompanying standard complete specification.

Full application details follow.

[71]	Applicant:	PLASMA PROCESSING CORPORATION
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[70]	Nominated Person:	PLASMA PROCESSING CORPORATION
	Address:	MILLWOOD, WEST VIRGINIA 25262-0249, UNITED STATES OF AMERICA
[54]	Invention Title:	REACTIVE NON-METALLIC PRODUCT RECOVERED FROM DROSS
[72]	Name(s) of actual inventor(s):	RICHARD DALE LINDSAY

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BASIC CONVENTION APPLICATION(S) DETAILS

[31] Application Number	[33] Country	Country Code	[32] Date of Application
902,025	UNITED STATES OF AMERICA	US	22ND JUNE 1992

Drawing number recommended to accompany the abstract ..... 1 .....

By our Patent Attorneys,
WATERMARK PATENT & TRADEMARK ATTORNEYS

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DATED this 21st day of June 1993.

Lynn P. Stafford

Registered Patent Attorney

M046681 210693

P/00/008b 12/11/91
Section 29 (1)
Regulation 3.1 (2)

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NOTICE OF ENTITLEMENT

(To be filed before acceptance)

We, **PLASMA PROCESSING CORPORATION**, of Millwood, West Virginia, 25262-0249, United States of America, being the applicant in respect of Application No. 41413/93 state the following:-

The Person nominated for the grant of the patent has entitlement from the actual inventor by assignment.

☐ The person nominated for the grant of the patent has entitlement from the applicant of the basic application listed on the patent request form by assignment.

☐ The basic application listed on the request form is the first application made in a Convention country in respect of the invention.

By our Patent Attorneys,
WATERMARK PATENT & TRADEMARK ATTORNEYS

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20 June 1996

Carolyn J. Harris
Registered Patent Attorney

AU9341413

(12) PATENT ABRIDGMENT (11) Document No. AU-B-41413/93
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 671121

(54) Title
REACTIVE NON-METALLIC PRODUCT RECOVERED FROM DROSS

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(56) Prior Art Documents
EP 329638
WO 91/09978
US 5102453

(57) Claim

1. Process of providing a reactive material containing aluminum nitrides comprising treating a material selected from the group consisting of salt cake, non-metallic products obtained from black dross and white dross, black dross, white dross and mixtures thereof as herein defined to remove chlorides from said material to below ~~about~~ 3% under conditions whereby the aluminum nitrides within said material are concentrated, thereby increasing the net energy value of the treated material to provide reactive non-metallic products (NMPs) ~~NMPs~~, and recovering said reactive NMPs for subsequent application.

2. The process of claim 1 wherein said treatment comprises a water wash treatment followed by drying.

3. The process of claim 1 wherein said treatment comprises milling, water washing and drying.

P/00/011 28/5/91
Regulation 3.2(2)

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ORIGINAL
COMPLETE SPECIFICATION
STANDARD PATENT

Application Number:

Lodged:

Invention Title: REACTIVE NON-METALLIC PRODUCT RECOVERED FROM DROSS

The following statement is a full description of this invention, including the best method of performing it known to :-

REACTIVE NON-METALLIC PRODUCT RECOVERED FROM DROSS

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FIELD OF THE INVENTION

This invention relates to the recovery of non-metallic product (NMP) from aluminum dross. More particularly, the invention relates to a process for the treatment of non-metallic product containing salt obtained from black dross or salt cake obtained from a process wherein aluminum dross is treated with salt in a furnace to remove free aluminum. "Black dross" as used herein is dross containing salt, usually added when treating aluminum ore to recover aluminum. "Salt cake" is the residue from the treatment of dross to recover free aluminum from dross where salt is used in the treatment of the dross. The NMP from black dross and salt cake contains substantial amounts of undesirable salt and, additionally, components such as aluminum nitrides and unrecoverable free aluminum. The present invention treats the NMP from black dross and salt cake to the extent of removing chlorides while retaining a high content of aluminum nitride and, to the extent possible, the unrecoverable free aluminum, to provide a reactive NMP.

BACKGROUND OF THE INVENTION

When a body of aluminum is melted in a furnace for purposes of recovering aluminum from ore or the like, dross forms on the surface of the molten aluminum and must be periodically removed, for example by skimming or similar operation. The removed dross generally contains substantial amounts of free aluminum as well as aluminum oxides and certain other metals and metal salts of magnesium, manganese, and lithium, depending on the nature of the aluminum or aluminum alloy being treated. In some processes, the

aluminum ore is treated with salt whereby the skimmed dross contains salt, which is labeled "black dross." It is desirable to recover from the aluminum dross to the extent possible the free aluminum since this free aluminum comprises substantial economic value. In one conventional way of treating the dross to recover free aluminum, a salt such as sodium chloride is used to blanket the molten dross. The free aluminum is then separated from the dross, providing free aluminum and a non-metallic product containing the aluminum oxides and other materials such as aluminum nitrides, aluminum chlorides and aluminum carbides, as well as substantial amounts of salt. The entire non-metallic materials recovered from the dross treatment are referred to herein as non-metallic products (NMPs). These non-metallic products, to a substantial part using the conventional salt treatment or obtained from black dross, are considered waste materials and conventionally are disposed of in landfills.

These non-metallic products since they contain salt and aluminum nitrides (AlN) cannot be disposed of in conventional landfills without treatment, however, since the salt can be leached out during rainfall and the aluminum nitrides are reactive when in contact with moisture, producing ammonium. As a result of this reactivity and ecological considerations, it has been necessary before carrying the NMPs to landfills to remove the salt and aluminum nitrides from the NMPs recovered from black dross or from salt cake. This has been conventionally done utilizing a desalinization plant wherein the NMPs from salt cake or black dross are exhaustively washed and treated to remove salt and the aluminum nitrides to as low a level as possible, preferably below less than one percent. The treatment is costly, and additional landfills are becoming scarce.

SUMMARY OF THE INVENTION

It has been found according to the present invention that it is advantageous not to treat the NMPs from salt cake or black dross so as to remove the aluminum nitrides. Rather it has been found that non-metallic products contain-

ing aluminum nitrides (AlN) can be milled and screened and then advantageously utilized to produce useful refractory, abrasive and the like articles. The AlN within the non-metallic product are reactive in processes converting the non-metallic product into useful refractories and the like articles to provide heat energy useful in forming the desired refractories and the like articles. The present invention, therefore, not only eliminates the need for the economically disadvantageous exhaustive desalinization treatment of the dross but also provides a useful source of raw material, eliminating the need to put the material into a landfill.

Accordingly, the present invention provides a process wherein a desalinization facility is associated with a dross treatment operation, designed and constructed to wash or mill salt cake or NMPs from black dross whereby the salt levels are reduced by such operations to about 3% or less but where the AlN levels are preserved as much as possible, preferably above about 7% and more preferably in the 12%-24% range. The process of the present invention provides a reactive material, ie., reactive NMPs from dross, containing reactive AlN. The process comprises the steps of treating salt cake or NMPs from black dross to remove the chlorides to below about 3% and concentrate the AlN within the reactive material, preferably above about 7% and more preferably in the 12%-24% range, thereby increasing the net energy value of the treated material. The conditions are controlled so as not to substantially reduce the AlN content. The preferred method of treatment according to the present invention is by water washing of the salt cake or NMPs from black dross, milling and drying or by milling the salt cake or NMPs from black dross followed by washing and drying.

The reactive NMPs will contain varying amounts of AlN depending on the starting material. Normally, however, the processed NMPs will contain from about 7% to 24% AlN. Additionally, the processed NMPs will contain unrecoverably

free aluminum in the amount of from about 2% to 8%. The AlN and free aluminum are an available energy source when converting the NMPs into useful articles. Thus, assuming 6% Al and 18% AlN content, for each ton of NMPs, the available energy is as follows:

2,000# x 18% = 360# AlN
2,000# x 6% = 120# Al

100# Al = 400 Kw-Hr energy
100# AlN = 218 Kw-Hr energy

120# Al = 480 Kw-Hr
360# AlN = 784 Kw-Hr
Available Energy = 1,264 Kw-hr/ton

The available energy, in processing the NMPs into abrasive or refractory materials, permits the reaction to proceed without substantial input of heat once the reaction temperature is reached, substantially lowering expected processing costs.

THE DRAWING AND DETAILED DESCRIPTION

The drawing schematically illustrates preferred treatment sequences according to the present invention. In a conventional aluminum processing operation, aluminum ore is melted in a furnace and the metallic aluminum is recovered along with dross resulting from an ore skimming operation. In operations which do not use salt in the treatment of the ore, salt-free dross or "white dross" is recovered. White dross containing high levels of aluminum nitride can be treated directly in a plasma energy furnace as disclosed in U.S. Patent Nos. 4,877,448, 4,997,476 and 5,030,273 to recover free aluminum and valuable non-metallic products containing reactive aluminum nitride. However, in processes where salt is used in the ore treatment operation to salt out the aluminum, black dross or dross containing salt is obtained. In the conventional processes for treatment of dross to recover free aluminum, i.e., before the use of

plasma energy was known, the dross, white or black, is heated in a refractory furnace to above the melting point of free aluminum. To help separate the free aluminum from NMPs, the dross is covered with salt. This process provided salt cake containing large amounts of salt as well as non-metallic product containing the reactive aluminum nitrides. As above stated, conventionally this material was exhaustively washed in a desalinization plant to remove all of the salt and aluminum nitrides to provide a suitable waste product for transport to a landfill. According to the present invention, this material is now washed only sufficiently to remove the chlorides, substantially lowering process costs, while retaining the aluminum nitrides to provide a valuable material for processing into refractories, abrasives and the like.

As illustrated in the drawing, salt cake or NMPs from black dross are fed to a multiple stage impact cage mill 10. This impact mill, through a hammering action, separates the aluminum metal particles from the salt and metal oxides. Thus, the hammering is such that it will knock the salt and metal oxide particles from the metal and fractionate these particles while substantially retaining the aluminum particles in their original size, at most causing some deformation of the particles. The material from impact mill 10 is then fed to a screening station 20 where the material having a particle size -20 mesh and below is separated and fed to either a minimum contact water digester 30 or to an ultra grind station 40. The material from screen station 20 having a particle size above 20 mesh and above is returned to the multiple stage impact mill 10. The impact mill 10 is a batch type mill, and "new" material is not fed to the impact mill until all of the original batch, after a series of passes through the mill, is processed to provide metal particles above about +20 mesh and the non-metal materials are reduced to a particle size below -20 mesh. In the drawing, three passes through mill 10 are shown. However, depending on the material, additional passes may be required.

The material having a particle size of +20 mesh will have a very high metal content and low salt content. This material is fed to a bin 50 where it subsequently will be fed to a plasma aluminum recovery furnace 60 of the type disclosed in U.S. Patent Nos. 4,877,448, 4,997,476 and 5,030,273 where free aluminum is separated from the NMPs. The NMPs will then be fed to an NMP post treatment station 70 for further processing and collected as oxides.

The material having a particle size of -20 mesh and below which was fed to the minimum contact water digester 30 is then sent through a screw classifier 80 from the minimum contact water digester and pumped through a filter 85. The solid NMPs are removed by the filter, with low solids water being passed through station 90 comprising an evaporator, crystallizer, centrifuge, filter and dryer which removes salt product 95. The water from the evaporator is returned to the minimum contact water digester 30, with makeup water being added as needed.

The NMP from filter 85 which is passed through a series of dryers 75 will have a chloride content of less than 3% with a high aluminum nitride content, preferably in the range of about 12% to 24%. After drying, the material is sent to NMP post-treatment section 70.

In an alternative embodiment, the material having a particle size of -20 and below is sent to ultra grinder 40 where the particle size is reduced to -200 mesh, which is then fed to an air floatation chamber 65. In this chamber, the heavy material which is NMPs having less than 3% chlorides is sent to NMP post-treatment section 70. The lighter material containing in excess of 3% chlorides is fed to the minimum contact water digester 30 for processing as above described. The milling and water washing is designed to remove substantially all of the chlorides in the NMPs while concentrating the AlN. It is desirable, therefore, to monitor the chlorides as the process proceeds.

The present invention provides a highly useful material from a material heretofore considered waste. How-

ever, even as waste, the material before it could be disposed of as waste in a landfill required extensive and costly treatment. The advantages of the present invention, therefore, are at least twofold: precluding the need for treating a waste by-product before it can be disposed of as waste, and providing a material having useful properties for useful applications.

Although the present invention is primarily illustrated with respect to NMPs from black dross and salt cake, it can at times be desirable to mix black dross and white dross with such materials to upgrade the metal and AlN content. Moreover, the present invention can be used with black dross and white dross, again to upgrade the metal and AlN content. As will be apparent to one skilled in the art, various modifications can be made within the scope of the aforesaid description. Such modifications being within the ability of one skilled in the art form a part of the present invention and are embraced by the appended claims.

~~THE CLAIMS~~:

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Process of providing a reactive material containing aluminum nitrides comprising treating a material selected from the group consisting of salt cake, non-metallic products obtained from black dross and white dross, black dross, white dross and mixtures thereof as herein defined to remove chlorides from said material to below ~~about~~ 3% under conditions whereby the aluminum nitrides within said material are concentrated, thereby increasing the net energy value of the treated material to provide reactive non-metallic products (NMPs), ~~NMPs~~, and recovering said reactive NMPs for subsequent application.

2. The process of claim 1 wherein said treatment comprises a water wash treatment followed by drying.

3. The process of claim 1 wherein said treatment comprises milling, water washing and drying.

4. A reactive material containing aluminum nitrides which is the product of the process wherein a material selected from the group consisting of salt cake, non-metallic products obtained from black dross and white dross, black dross, white dross and mixtures thereof as herein defined is treated to remove chlorides from said material to below ~~about~~ 3% under conditions whereby the aluminum nitrides within said material are concentrated, thereby increasing the net energy value of the treated material to provide a material containing reactive aluminum nitrides.

5. The material of claim 4 wherein said aluminum nitrides comprise from 3%-24% of said material.

6. The material of claim 4 wherein said aluminum nitrides comprise from 12%-18% of said material.

DATED this 21st day of June 1993.
PLASMA PROCESSING CORPORATION

WATERMARK PATENT & TRADEMARK ATTORNEYS
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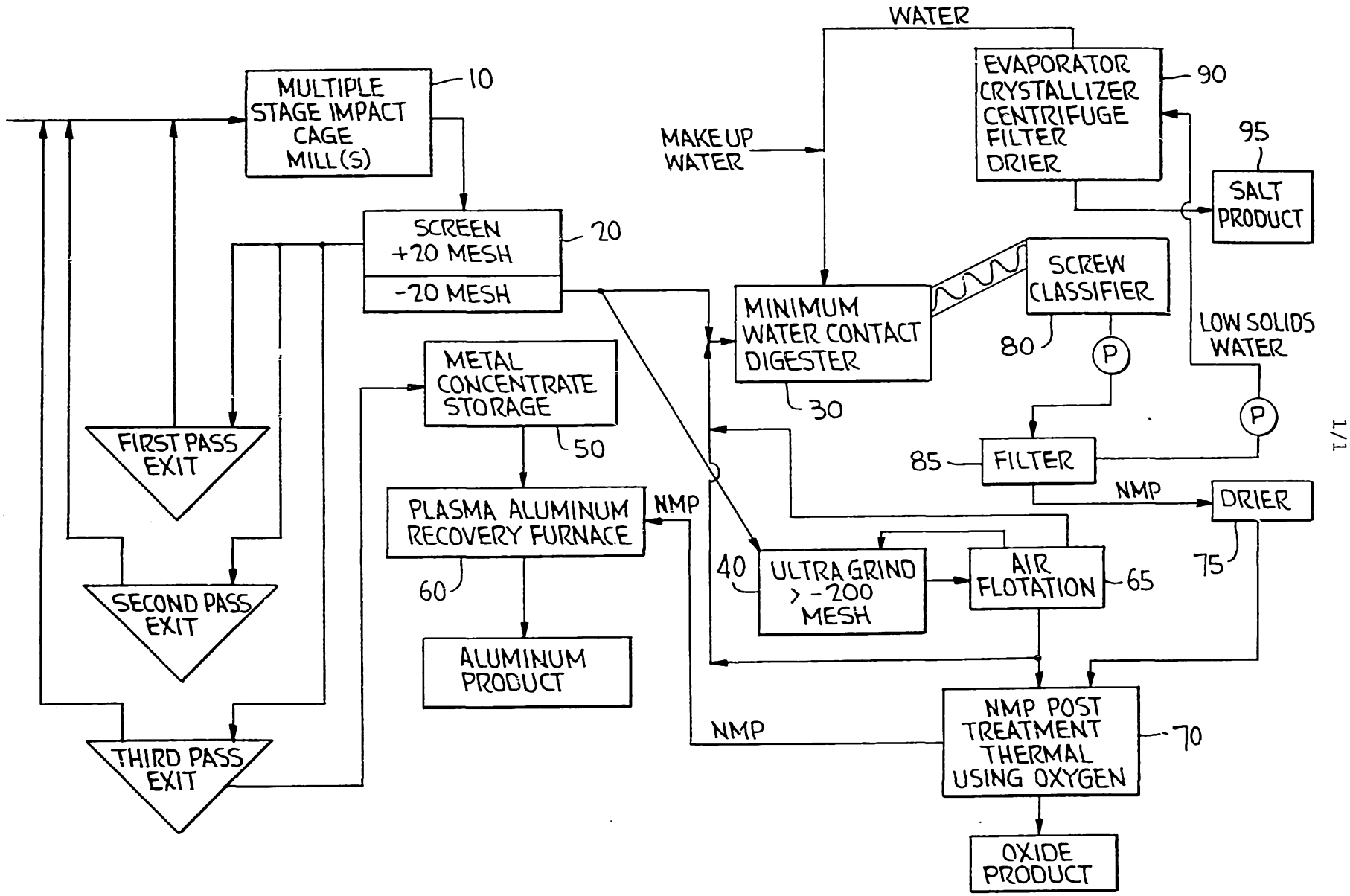
HAWTHORN. VIC. 3122.

ABSTRACT OF THE DISCLOSURE

A process for treatment of salt cake or non-metallic products obtained from black dross as herein defined to remove chlorides to below about 3% under conditions whereby the aluminum nitrides within the treated material are concentrated, thereby increasing the net energy value of the treated material to provide reactive non-metallic products. The reactive non-metallic products are converted into refractory or abrasive articles using low energy input levels.


WATER
MULTIPLE STAGE IMPACT CAGE MILL(S)
10
EVAPORATOR CRYSTALLIZER CENTRIFUGE FILTER DRIER
90
95
SALT PRODUCT
MAKE UP WATER
SCREEN +20 MESH
-20 MESH
20
SCREW CLASSIFIER
MINIMUM WATER CONTACT DIGESTER
30
80
P
LOW SOLIDS WATER
P
METAL CONCENTRATE STORAGE
50
FIRST PASS EXIT
85
FILTER
NMP
DRIER
75
PLASMA ALUMINUM RECOVERY FURNACE
NMP
60
40
ULTRA GRIND > -200 MESH
AIR FLOTATION
65
SECOND PASS EXIT
ALUMINUM PRODUCT
NMP
NMP POST TREATMENT THERMAL USING OXYGEN
70
THIRD PASS EXIT
OXIDE PRODUCT

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