

Patentstyret
Boks 8160 Dep
0033 Oslo

Trondheim-office:
Industriveien 53
N - 7080 Heimdal
Norway
Phone +47 7285 7300
Fax + 47 7285 7301
curo@curo.no
www.curo.no
NO 936 803 911 MVA

Oslo-office:
Kjeller Teknologipark
Phone + 47 7285 7310

Patentavdelingen

Per G. Berg*
Erland Smemo*
Thor Saether*

**European Patent Attorneys*

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Vi viser til uttalelse fra Patentstyret av 12. oktober 2014.

I betraktning av det nye regelverk under London Agreement med virkning fra 1. Januar 2015, ber vi om at all fremtidig korrespondanse i denne sak, så langt regelverket gjør det mulig, utferdiges på engelsk. I tråd med dette er kommentarene og argumentene nedenfor også skrevet på engelsk.

The present invention

The present invention, as defined by claim 1, relates to a quite specific process in the area of alumina/ aluminium and related valuable bi-products and is already in the preamble defined by no less than seven individual steps, taking into account the also detailed prior art in this area.

The specifics or *characterizing* part of the invention are detailed in a number of bullet-points providing further details of steps 2, 4, 5, 6, and 7 of the process. The detailing steps are as follows, for easy reference provided with indices (i–vi) not present in the claims as filed:

- i. leaching the material in step II with a concentrated mineral acid which is predominantly HCl,
- ii. separating the Al^{3+} in step IV by precipitation of $AlCl_3 \cdot 6H_2O$ by increasing the HCl concentration in the metal chloride solution,
- iii. calcination in step V the $AlCl_3 \cdot 6H_2O$ in two sub-steps: First by indirect heating at temperature between 400 and 600°C to generate a HCl-rich gas followed by a second calcination at a temperature above 600°C to produce Al_2O_3 ,
- iv. mixing in step VI the Al-lean metal chloride solution with an organic solution containing a selected amine and contacting the mixture with a CO_2 -containing gas, in order to extract HCl by formation of an ammonium chloride salt complex and to precipitate a metal carbonate,
- v. separating the metal carbonate in step VI, the remaining metal chlorides containing aqueous phase and the organic solution containing ammonium chloride salt complex,
- vi. processing thermally or chemically the organic solution in step VII to regenerate the amine for recirculation in the process.

We will revert to these points more in detail in the prior art discussion below.

Prior art discussion

While Examiner has cited a total of 7 prior art publications, it appears that the documents seen as most crucial are D1 seen in view of D5, possibly D1 seen in view of D7.

While commenting on the content of these as such (one by one) hereunder, the specific discussion of the inventive step in the format of the problem/ solution approach, has this as a basis.

D1 ("New technology for production of alumina from alternative feedstock", FOSSUM, I.S. (Nordic Mining ASA), SCHANCHE, M. (Nordic Mining ASA), 20th Bauxite & Alumina Conf., Miami, 26th February 2014. (url: <http://www.nordicmining.com/getfile.php/Bilder/Innovation/Alumina/Mona%20Schanche.pdf>)) is a conference presentation which is silent with regard to most of the specific details of the process for which a patent is applied. The general steps mentioned in the preamble of claim 1 can be found, though not indicated as specifically as I claim 1, while the details given in the characterizing part of claim 1 are generally missing. One exception to this is the express mention of HCl for the leaching step, cf. page 15. Addition of CO₂ is also indicated in D1 for the precipitation of calcium carbonate, but not in the specific context given in point iv above (and thus in claim 1).

It is our assertion that with regard to the specific details of the present invention as defined by the steps ii – vi above, there is no guidance for the person skilled in the art.

It is also worth noting that the present process is *not* "based on Anortal project", but shares - only partly - general objectives and previous chemical knowledge with state of the art attempts, to develop a new process that tackles all the unsolved problems. This is explained in pages 12 and 13 of D1.

D2, (US4158042 A 19790612 ALCAN RES & DEV), utilizes the chemical reaction of dissolving a mineral (rich in aluminium atoms) with an acidic solution with added fluoride, to later separate aluminium by precipitation of aluminium chloride. D2 does not tackle the enormous generation of solid residue (CaSiO₃), the high energy consume to produce this residue for extra HCl recovery, and do not produce any commercial product further than alumina. Therefore, the process was not commercial and had expected high environmental impacts. More technically, the entire D2 process configuration largely differs from the proposed patent: the extraction of the alumina requires the recirculation of part of the liquor and the precipitation of aluminium chloride is achieved combining different sub-processes (apparently with high energy consumption). Therefore, the common scientific aspects between D2 and the proposed patent are: the dissolution of minerals by HCl and the, also well-known, common-ion effect, that causes the precipitation of species when adding the common ion into a solution. How these chemical phenomena are used in D2 for an economic and environmental benefit drastically differ from the proposed invention. Therefore, reading D2 cannot foster the invention of our proposed process, even in combination with other related publications.

D3, (US4110399 A 19780829 INST FOR ATOMENERGI), similarly to D2, the authors highlight that D3 process not only lacks "process steps" but it is, again, drastically different in the process configuration and the chemistry involved: the leaching step includes H₂SO₄ utilization, with the corresponding variations along the process and the recovery of aluminium chloride is again differently solved, as explained in detail in the patent proposal and Figures 3 and 4.

D4 (US4472361A 19840918 ALCAN INT LTD) relates to only one of the process steps to separate aluminium and sodium cations, with HCl recovery, and provides a technological option based on the chemical common-ion effect. In our proposed technology, two innovative technological solutions are offered, based on the same scientific principle, but developing different technological solutions in both cases, as explained in pages 6 and 7 and Figures 3 and 4 of the patent proposal, where we directly compare our solution with Deutchman and Tahiani process (D4). With our first preferred solution (Figure 3b), the expected accumulation of impurities in Deutchman and Tahiani process is solved. In the second preferred embodiment, our inventive solution improves as well the overall efficiency of the separation, together with the impurities accumulation issue.

D5 (US4321247 A 1982-03-23 HUELS CHEMISCHE WERKE AG) is a process to produce sodium bicarbonate and hydrogen chloride from an aqueous sodium chloride solution with CO₂ in the presence of an amine and an organic solvent. The first statement in the background of the invention in D5 is: “The field of the invention is sodium bicarbonate production.” The process is presented as an alternative of the Solvay process, being the world’s main technology for the production of sodium carbonate, by calcining the sodium bicarbonate.

Most important affirmation is: “The drawback of the Solvay process essentially is therefore that all the chlorine of the reacted sodium chloride is lost in the form of worthless calcium chloride, and that furthermore the unconverted sodium chloride also is lost”, ref. col. 1, lines 47-49. Therefore, the inventors behind D5 did not consider applying their own technology for calcium chloride recovery as precipitated carbonate and HCl recovery, but focused their efforts in obtaining sodium bicarbonate from a different solution. The only alternative application mentioned is the production of potassium bicarbonate and hydrogen chloride from potassium chloride and carboxylic acid.

The field of application is absolutely disconnected from mining industry, minerals dressing or alumina production and the inventors of D5 openly disregarded (as “worthless”) the potential of calcium chloride solutions for acid recovery. Attention should be drawn specifically to the fact that this process is a process for producing sodium bicarbonate, not for the production of PCC and most certainly not for the production of alumina. As such the process is not related to mining industry.

These facts make impossible that a person skilled in the state of the art (i.e. of mining industry and alumina production) could and would invent the process of our patent application by only reading and understanding document D5, in combination with any or several of the state of the art publications.

D6 (NO323417 B 20070430 INST ENERGITEKNIK) is referred in our patent application as one of the unsuccessful past attempts to process anorthosite for alumina production. D6 is based in the dissolution of anorthosite with nitric acid followed by subsequent solvent extractions of Fe and Ca and partial acid recovery. Neither the general chemical reactions, nor the necessary chemicals (acid type and extractants), nor the process steps or process conditions are common with our invention. Only partially the objective (alumina production) and part of the final products (PCC and alumina) are common. Therefore, the reading and understanding of D6 alone or in combination with other publications cannot result in the invention of our process.

D7 (“Development of a new pH-swing CO₂ mineralization process with a recyclable reaction solution”, S. KODAMA et al., Energy 33 (2008) 776–784). Similarly to D5, the field of application is unconnected with minerals dressing and alumina production. The authors of D5 propose a new CO₂ mineral sequestration process to be applied in alkaline-earth metallic solutions from silicate waste materials such as steelmaking slag or waste concrete. They proved and documented the chemistry of CO₂ sequestration by using steelmaking slag and ammonium chloride solution, using “the pH swing of an ammonium chloride solution”, as stated in the conclusions. No production or regeneration of HCl takes place, and no amines or other organics are used in their carbonation process. Again, a person skilled in the art of alumina production from anorthosite (or another mineral) cannot invent our process by combining this publication with the state of the art publications in the field or application.

Inventive step in context of the problem/ solution approach

The problem/ solution approach involves the steps, of:

- identifying the closest representative of the prior art
- defining the objective technical problem solved by the present invention, and
- when combining D1 with any (single) additional prior art, assessing whether a person skilled in the art *would* arrive at the present invention (not could, *would*).

Examiner has indicated that D1 is to be regarded as the closest prior art. Without stating it explicitly it seems that Examiner considers D5 and / or D7 to be the best candidates for a combination with D1 under a discussion in relation to the problem/ solution approach to inventiveness.

Since D1, contrary to a patent or patent publication, is not under the obligation of presenting a technological solution in a complete manner, so that a person skilled in the art would be able to carry out the invention, it does not. Therefore defining the objective technical problem to be solved can be done in a number of ways; like: *Providing a concrete, practical, technical solution of the broad process scheme outlined by D1.*

The present invention solves this problem in a manner detailed by six concrete steps quoted on page 1 above, and a person skilled in the art would not arrive at the detailed, specific process of the present invention by combining D1 with D5 or with D7 (nor with D2, D3, D4 or D6 which has not been asserted).

As evident from the discussion of D5 above, the D5 process is only relevant for one step of the steps I – vi listed above - and as such present in the characterizing part of claim 1 -, namely the step of acid recovery, step vi.

Thus, a combination of D1 and D5 is silent about the process steps ii, iii, iv, and v.

As also evident from the discussion above, a combination of D1 with D7 is silent about the process steps ii, iv, v, and vi of claim 1.

In fairness, a person skilled in the art would not arrive at the detailed, specific process of the present invention by combining D1 with D5 or with D7 (nor with D2, D3, D4 or D6 which has not been asserted).

Claim amendments as response to formal deficiencies

An amended set of claims is enclosed in which the sole amendments are found in claims 11 and 15.

In claim 15 a few words have been deleted as suggested by Examiner, while in claim 11 the words “or similar existing process” are replaced by “or other existing concentrating process”. This expression is not found as such in the application as filed, but any chemists know that distillation is a concentration process, and others should not be ruled out.

Conclusion

As demonstrated above, the present invention is well distinguished over the prior art and exhibits an inventive step as required by PL § 2.

We understand that there is a lot of information to take into consideration in this application and we would like to have the opportunity to have a meeting with Examiner – formal or informal – to discuss the technical details of this invention in even further detail than here, hereunder to have the opportunity to provide answers to any questions that the Examiner might have in same connection.

Kind Regards



Per Berg

Enclosures Amended set of claims.