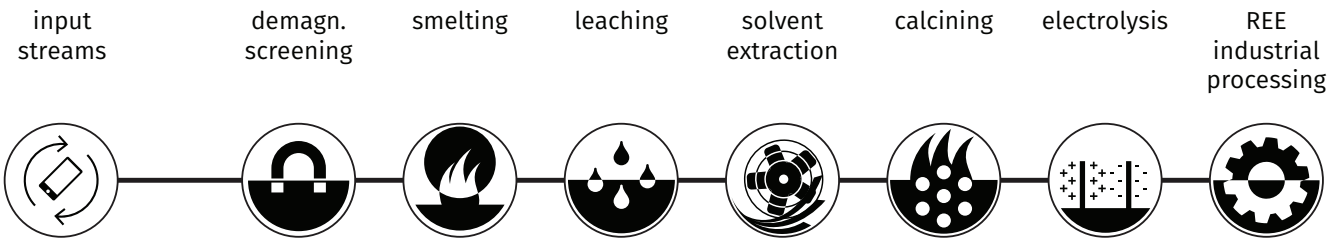
REEcover

Technology licensing opportunity

Rare earth magnet material recovery from WEEE

Preparing for the turn in the REE market



process step	1	2	3	4	5	6	overall total
volume/year in mt	173.585	7.100	914	---	115	89	89
resulting concentration REE in ppm	15.569	228.914	leach liquor m^3 0.612/0.648	390.000	857.400	1.000.000	1.000.000
recovery of Nd in %	98.6	96	98.7	96.8	100	90	81.5
recovery of Dy in %	98.9	100	98.8	95.9	100	90	84.6
recovery of Pr in %	98.3	97	98.8	96.3	100	90	81.1

PROJECT DESCRIPTION

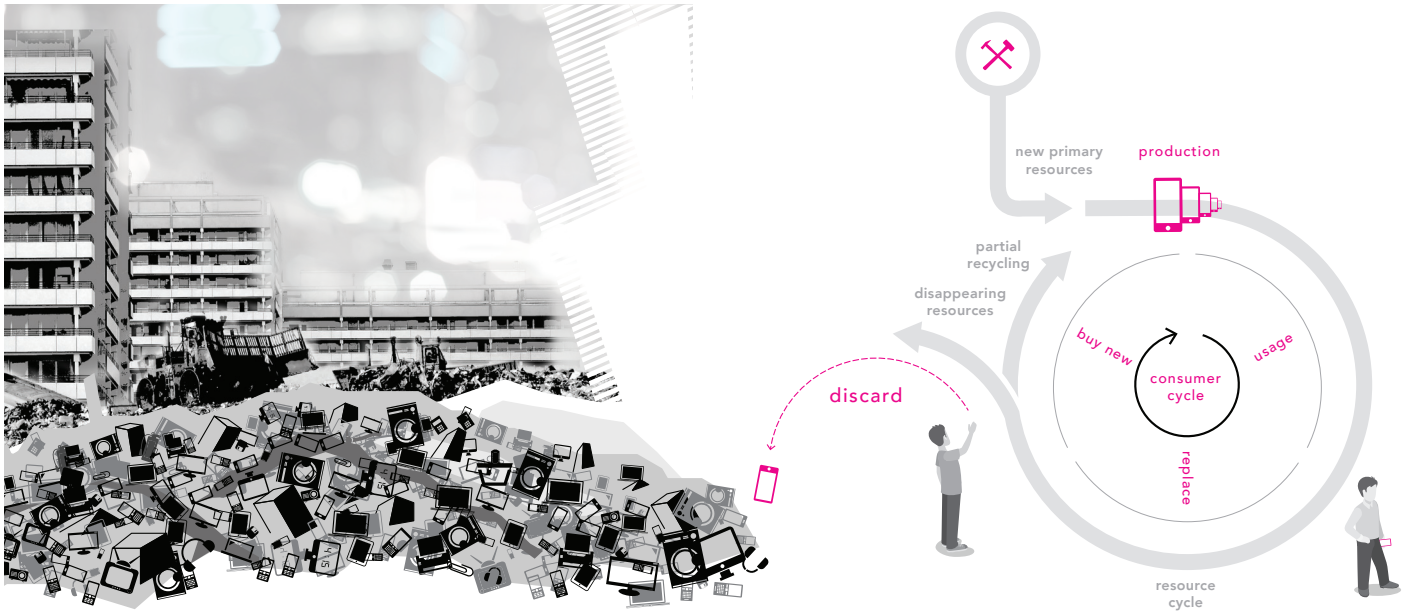
summary

Those familiar with the rare earth elements (REE) market will vividly remember the extremely strong rise in REE prices in the period 2011-2012, reflecting sudden changes in particular Chinese market policies. China is currently still dominating the market with 90% of global production, and though prices have returned to lower levels, the supply-demand balance is expected to shift leading to higher prices. This is the consequence of increasing use of magnets in among others clean energy applications and personal devices.

The REEcover consortium, consisting of leading technology organisations in the field of metallurgy, WEEE processing and REE, has now developed a complementary train of processing technologies in the framework of a strategic EU project, financed by EU FP7 program.

The process chain can efficiently extract the REEs neodymium, dysprosium and praseodymium from standard WEEE processing chains. With a recovery of REE world market prices or a subsidy on CAPEX this particular process chain offers interesting returns on investment for WEEE processors, as an extra source of income from existing streams.

Why be surprised again by world market changes? By acquiring a license on the REEcover technology you will be prepared for the expected market change to process REEs from WEEE.



technology description

This novel and practically applicable technology is an integrated package of consecutive process steps, some of which are highly innovative and proven, and with all steps proven at least at the laboratory scale.

A commercially attractive mixed magnet alloy (Nd, Pr and Dy) is produced, starting with the standard WEEE plant output, after screening and demagnetisation, smelting, leaching, solvent extraction, calcining and electrolysis. After a basic design and demonstration scale testing the technology can be introduced at a large scale. The process is modelled in Metsim, a robust and proven flowsheet simulator, giving confidence to the mass flows and the resulting operating cost predicitons.

REEcover research group

The REEcover research group has managed to effectively combine theoretical, practical and commercial know-how on REE recovery in a multifaceted expert group that jointly developed a fully integrated processing chain. This expert group consists of NTNU (Norway, project coordinator), SINTEF (Norway), LTU (Sweden), Metsol (Sweden), TU Delft, BCC (NL), Elemetal (NL), Chemconserve (NL), TECNALIA (ES), Less Common Metals (UK), LKAB (Sweden), Simtec (Fr) and Indumetal Recycling (ES).

The REEcover method comprises and integrates a series of process steps, starting with physical separation and demagnetisation, followed by hydrometallurgy and pyrometallurgy steps and concludes with the production of pure metal through electrolytic reduction.

Unique Selling Points versus existing methods

It is for the first time that a low cost re-usable material is being produced from standard scrap material from the market and through standard processing steps as practiced by European WEEE companies, making the REEcover technology truly unique and attractive for integration into existing businesses.

key financial parameters

The process has been modelled on a WEEE processing output of an existing and representative 25k mt plant in Northern Spain, containing typically 600 ppm REEs. Assuming an investment in equipment (estimated at €20 million, to be confirmed by basic design), the output streams of a modelled 270.000 mt WEEE plant would result in an annual production of 90 mt of commercial grade REE (Nd, Pr and Dy) for further processing, at a total cost per kilo of €60. At a (future) world market price of € 120 for Nd, an IRR of 30% on this investment would result. A strategic EU or regional investment promotion subsidy on the assumed €20 million CAPEX of 65% (€13 million) would already result in an IRR of 30% at a current weighted average REE market price of €60.

envisaged technology transfer and commercial process

After discussion of more detailed process description and initial transfer of non-confidential key performance parameters and process characteristics, interested parties are invited to sign a term sheet with the main conditions of a two milestone-driven transaction after which the process details are transferred. Based on verification of the results of tests at lab/pilot scale, and the consecutive basic design of a plant, REEcover staff members will provide consulting services in the transfer of the technology to the scaling up of the technology up to commercial plant level. The technology license is based on royalty payments of the realised sales value of units produced.

technology transfer team

The core technology transfer team is coordinated by Marco Pieterse of Chemconserve, a senior business venture development and technology transfer professional in early stage (clean technology) companies.

team members

The technology transfer team consists of:

- Dr. Mark W. Kennedy (NTNU, Norway) is the operational project leader and process metallurgist with extensive non-ferrous and light metal experience and knowledgeable in electric furnace design.

- Dr. Mårten Görnerup of Metsol (Sweden) is co-project leader and has a vast experience in hands-on operations of metals production in combination with a solid R&D background, a valuable combination that ensures a research output adapted to industrial needs.

- Assoc. Prof. Dr. Yongxiang Yang of TU Delft (Netherlands) is proces metallurgist specialised in metals extraction, refining and recycling, thermal waste processing, and secondary resource utilisation.

- Chris Hall (UK) is Technical Director of LCM Ltd. Chris is responsible for new product development, ICT, quality systems and the analytical laboratory at REE processor Less Common Metals (LCM).

- Ms Dorleta Guarde of Indumetal Recycling's Technical Office and R&D department

- Ir. Bert-Jan Kuipers. MSc TU Delft Chemical Engineering. Founder and Director of Technology at Elemetal BV, a company focused on the upcycling of copper from waste streams, such as the bottom ashes from municipal waste incinerators. 5 years of experience in hydrometallurgical recycling applications.

advisory board

The team is advised by Prof. Dr. Gabriella Tranell (NTNU, Norway) at the Department of Materials Science and Engineering with longstanding experience as project- and research manager in metallurgy, and Assoc. Prof. Bertil I. Pålsson (LTU Sweden) of the Division of Minerals and Metallurgical Engineering and specialist in physical separation.

contact details

Parties interested in further information on the acquisition of a technology license are invited to contact us at:

Chemconserve BV

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