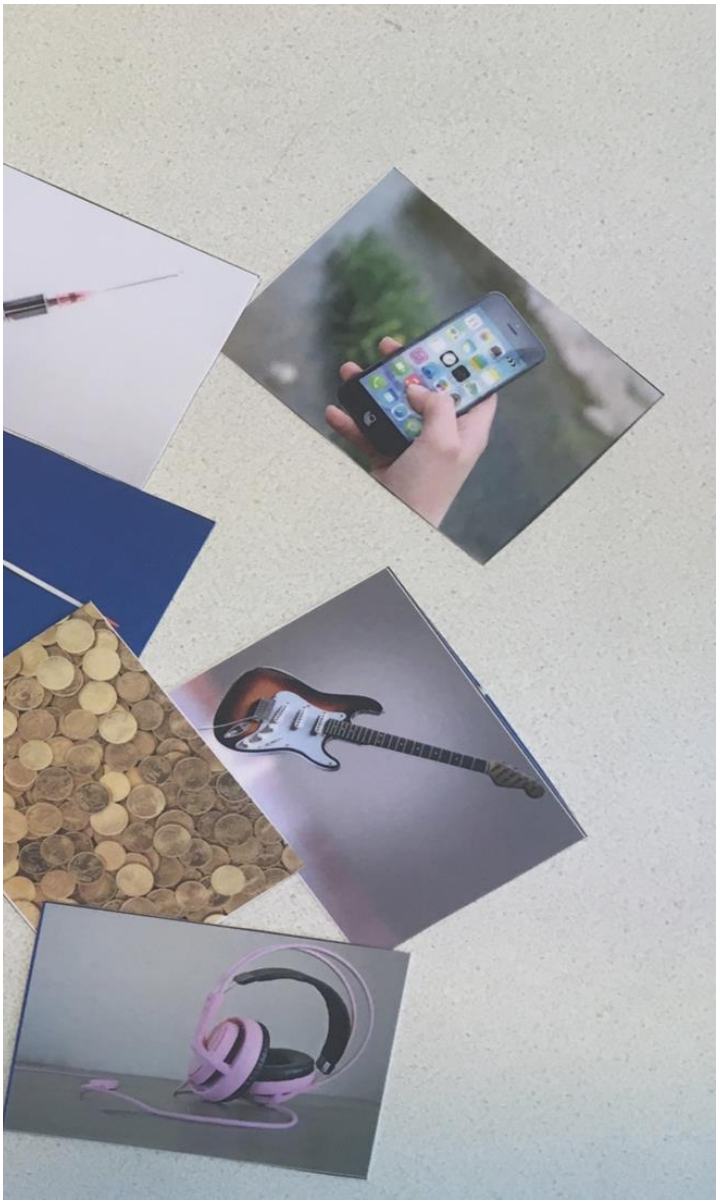
SecREEts Workshop

SecREEts

Secure European Critical Rare Earth Elements

This project has received funding from the European Union's horizon 2020 Research and Innovation Programme under Grant Agreement No 776559



SCHOOL LAB – Hanau

20 September 2022

Led by Prospex Institute
With Vacuumschmelze

About SecREEts

SecREEts is a project receiving funding from the European Commission Horizon 2020 programme for research & innovation. It aims to establish a secure and stable supply of Rare Earth Elements (REEs) in Europe, using sustainable extraction methods from European apatite sources used in the production of NPK fertilisers. SecREEts partners are developing pilot processes for a sustainable extraction, separation and manufacturing of REEs to create permanent magnets for application to areas such as electric vehicles, industrial motors, wind turbines, with replication potential in consumer products or medical equipment. The main objective of SecREEts is to set up a new integrated European value chain for extraction, refining and production of REEs.

SecREEts partners are:
SINTEF AS – Norway – Coordinator
Yara International ASA – Norway – Industrial pilot
REEtec AS – Norway – Industrial Pilot
Less Common Metals Ltd – UK – Industrial Pilot
Vacuumschmelze GMBH & Co kg – Germany
Quantis – Switzerland
Institut National de l'Environnement et des Risques INERIS – France
Prospex Institute vzw – Belgium

Please find all relevant information and latest updates on the project website: www.secreets.eu

Citizen Engagement in SecREEts

As part of the SecREEts Public Engagement Strategy, Prospex Institute regularly organises Citizen Labs, to engage local communities in areas where industrial partners are established. On variety of these Citizen Labsare activities specifically designed to engage with local youth (Student Labs) aimed at introducing rare earth, and representing an opportunity for young students to learn about the challenges and opportunities of emerging technologies.

As part of the German Citizen Labs, a Student Lab took place on 20 September 2022 in Hanau. During the workshop, REEs and permanent magnets were presented to a group of 17 local student.

Together with VAC, Prospex Institute introduced the topic of REEs and the SecREEts project. The project team used presentations, interactive exercises and question and answer sessions to help the local students to understand the importance of REEs, the activities carried out in the project and to discuss potential solutions to address some of the current challenges of the permanent magnet market in Europe. Moreover, as part of the workshop, at the end of the meeting students were also invited to a site visit of the Vacuumschmelze factory.

List of Abbreviations

- PI: Prospex Institute
- RE: Rare Earths
- REE: Rare Earth Elements
- USA: United States of America
- UK United Kingdom
- VAC: Vacuumschmelze

1 – Welcome and introductions

After welcoming the group of students and SecREEts project partners to the workshop, lead moderator Katharina Faradsch from Prospex Institute (PI) showed a video of neodymium magnets destroying everyday objects

For the next intervention Katharina invited Dr. Matthias Katter, Head of Permanent Magnets at Vacuumschmelze (VAC) - who introduced himself and Dominik Ohmer (VAC) to the audience – to take the floor for his presentation

*2 – Presentation: "*Introducing Rare Earth Elements and SecREEts" - *Matthias Katter from Vacuumschmelze*

After welcoming participants on behalf of VAC Dr. Matthias Katter, Head of the R&D department for Permanent Magnets, gave a first presentation introducing students to rare earths and their usage in magnet production.

The presentation covered the following points:

- What are rare earth elements?
- Why are they called "rare"?
- Why are they used to make magnets?

The full presentation can be found in the Annex.

3 – *Activity:* Guess the item

After pupils had been introduced to the world of rare earths and permanent magnets, Katharina Farasdch (PI) introduced the first activity to the students. Divided into four groups and using flashcards representing different items, student had to reflect and answer the following question:

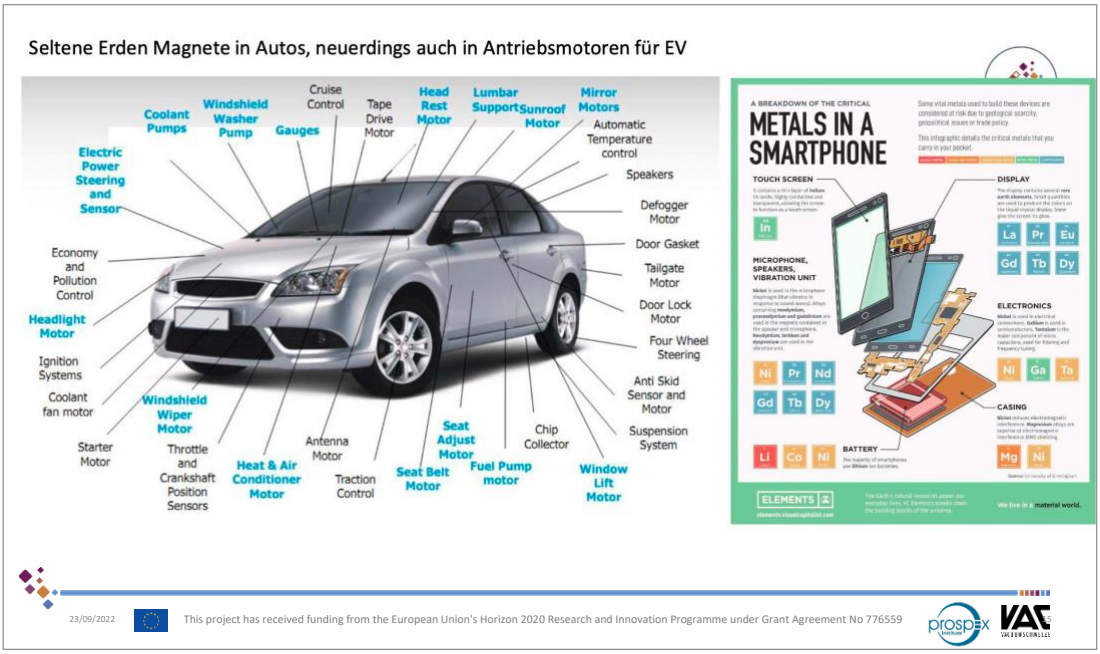
Which of the following items contain rare earth elements?

Answers from the student audience:

Smart Phone:	***Syringe:***	***Electric guitar***	***Wind Turbines***	***Keys***
Yes	*No*	*Yes*	*Yes*	*No*
Yes	*No*	*Yes*	*Yes*	*No*
Yes	*No*	*Yes*	*Yes*	*Yes*
No	*No*	*Yes*	*Yes*	*Yes*
Headsets	***Laptop***	***Coins***	***Electric Cars***	***Speakers***
Yes	*Yes*	*No*	*Yes*	*Yes*
Yes	*Yes*	*No*	*Yes*	*Yes*
Yes	*Yes*	*No*	*Yes*	*Yes*
Yes	*Yes*	*No*	*Yes*	*Yes*

Katharina Faradsch with the help of Dr. Katter provided the students with the correct answer and jointly reflected with them about the reason behind each answer.

Dr. Katter concluded the exercise by showing an infographic illustrating a detailed overview of the industries that use REEs and the types of products they are found in.



4 – *Activity*: Rare Earths in the world and criticality

Having made it clear what REEs are used for and their omnipresence in their everyday life, Francesca Ferrara from Prospex institute introduced to the audience the next exercise starting with the following question:

1) *"Which countries in the world do you think have the largest deposits of REEs?"*

Answers from the audience:

- *China*
- *Russia*
- *USA*
- *Brazil*
- *India*
- *Australia*

After a short bringing together of the answer, Francesca asked a follow-up question:

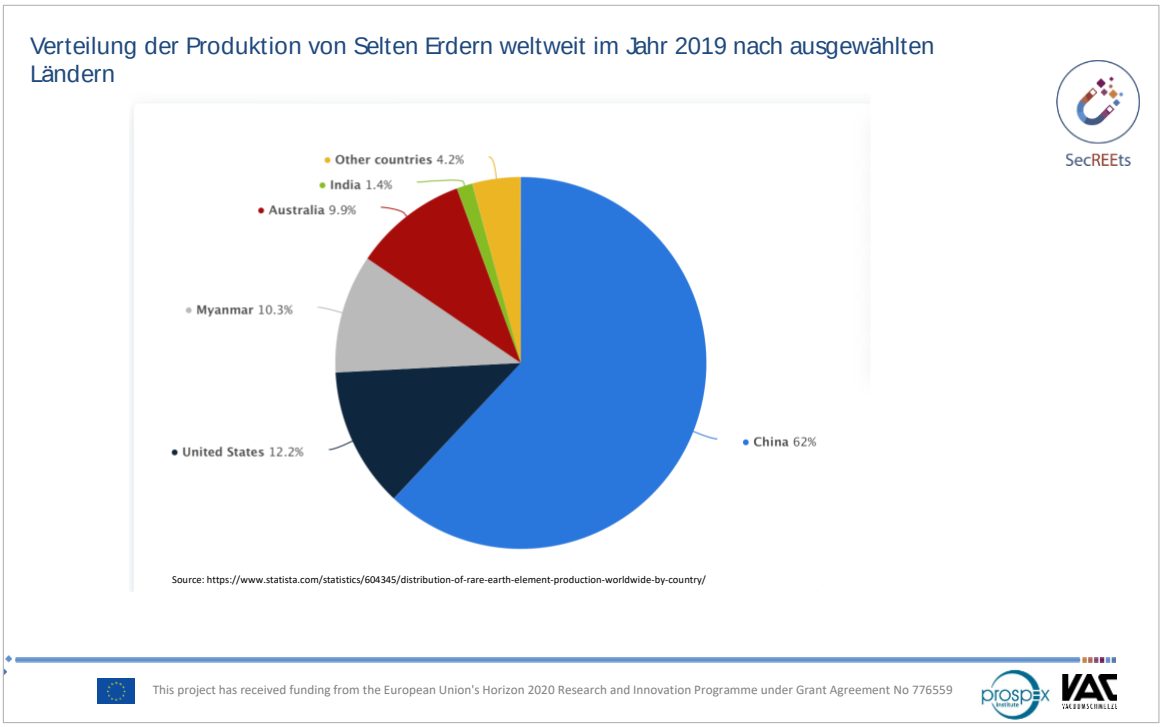
2)Which countries do you think manufacture the largest number of products containing REEs?"

Answers from the audience:

- *USA*
- *Spain*
- *United Kingdom*
- *Europe*
- *Germany*
- *Switzerland*
- *China*
- *Russia*
- *Japan*
- *United Arab Emirates*

Responses were collected using two different colours of sticky notes on a world map.

Francesca Ferrara then invited Dr. Matthias Katter and Dominik Ohmer (VAC) to comment and review participants answers, before showing an infographic depicting the distribution of REE production in the world.



5 – *Activity:* Thinking about solutions

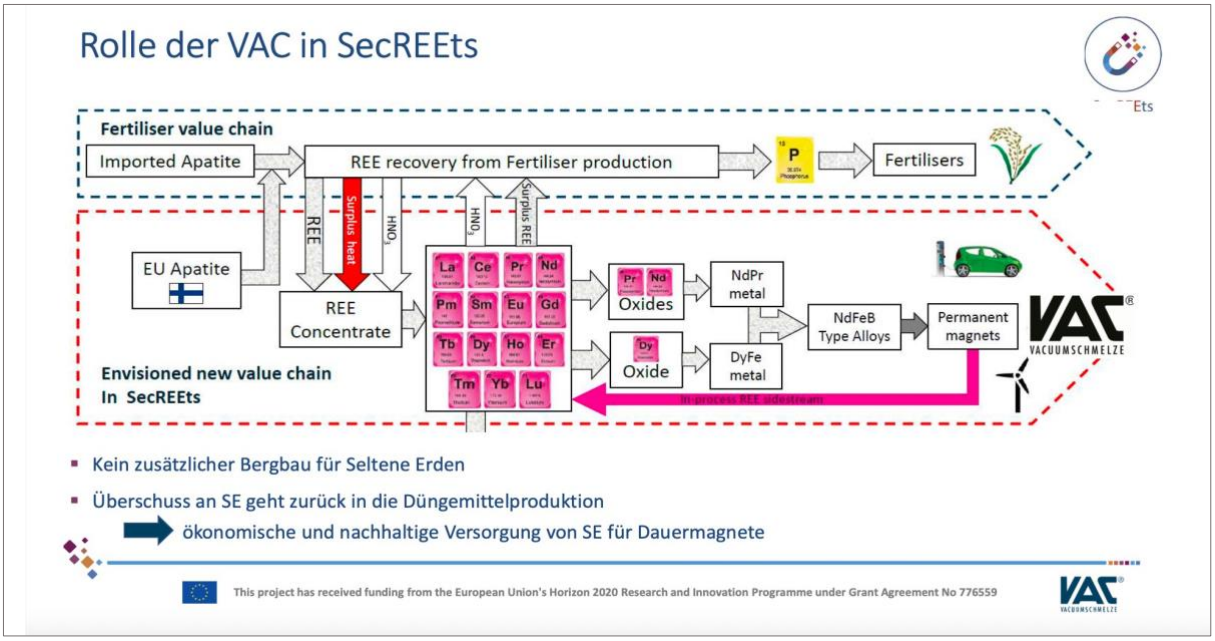
Once the global context of REE production and the strategic importance was clear to the student audience, Katharina Faradsch took the floor again, asking students to reflect and think in groups about solutions to minimise the risks related to REE criticalities.

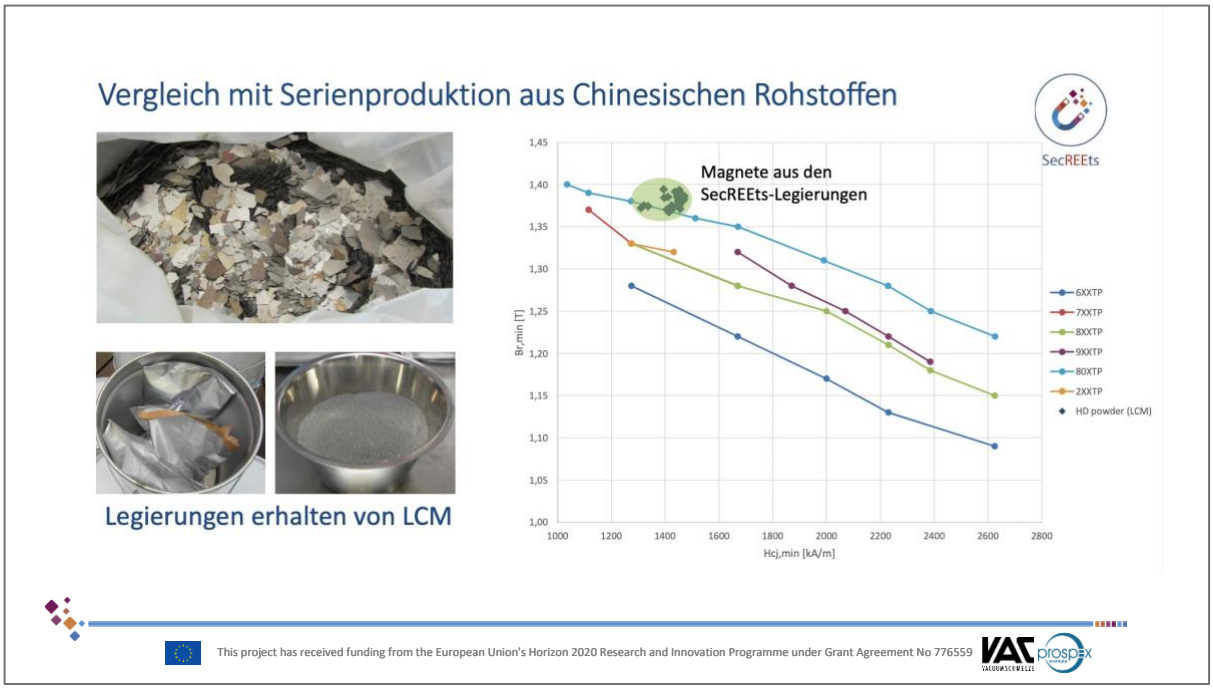
To different student groups proposed these solutions:

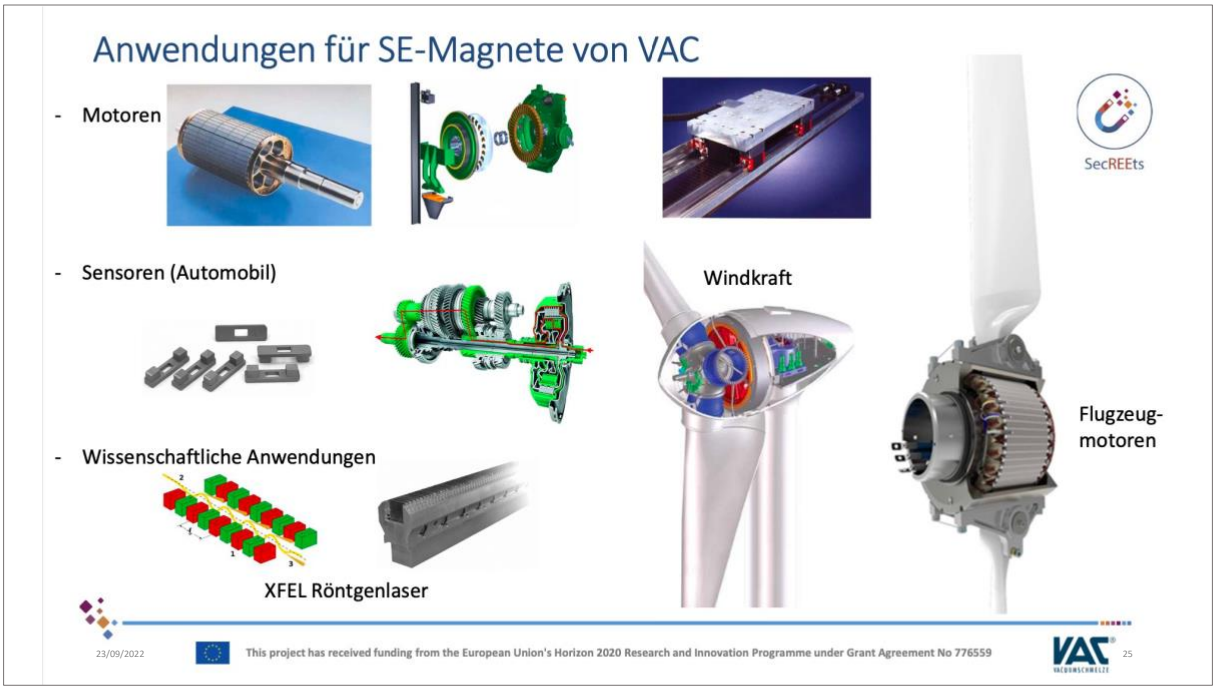
- recycling (x4)
- producing less (x2), using less REE in certain items e.g. smartphones, and use them instead in other applications
- find other production sites (x2)
- dismantling and technical modernization, developing new methods
- own production
- becoming independent from China

6 – *Presentation* “The role of Vacuumschmelze” – *Dr. Matthias Katter from Vacuumschmelze*

After reflecting on the solutions proposed by students, Dr. Mathias Katter from Vacuumschmelze (VAC) gave a more detailed presentation about the role of VAC in the consortium, the activities, and steps of the SecREEts project conducted in Hanau.







7 – Wrap-up

At the end of the workshop, Katharina Faradsch (PI) thanked the participants for their active contribution as well as the speakers for their presentations. Dr. Matthias Katter then invited participants to join him for the VAC site visit.

Evaluations

Each of the 4 student groups received an evaluation form to fill in at the end of the meeting. These evaluations are designed to help the SecREEts team get feedback on their public engagement activities in general and the Citizen Labs more specifically.

Students were asked to answer the following questions:

1. How would you rate the Citizen Lab in general?

Please mark	Very good	Good	OK	Bad	Very bad	No opinion
Number of answers	4	0	0	0	0	0

Comments

- It was very interesting and the explanations easy to follow

2. How much did this lab help you understand what the SecREEts project is doing?

Please mark	Very much	Much	Somewhat	Little	Very Little	No opinion
Number of answers	0	3	1	0	0	0

Comments

- *No comments*

3. How much did this lab help you understand about what the SecREEts project has done in Hanau so far, and what it will do next?

Please mark	Very much	Much	Somewhat	Little	Very Little	No opinion
Number of answers	0	4	0	0	0	0

Comments

- *No comments*

4. How much were you enabled to contribute to the discussion?

Please mark	Very much	Much	Somewhat	Little	Very Little	No opinion
Number of answers	0	1	2	0	0	0

Comments

- *No comments*

5. If you joined us on the VAC site visit, how would you rate the site visit?

Please mark	Very good	Good	OK	Bad	Very bad	No opinion
Number of answers	2	1	0	0	0	0

Comments

- *No comments*

Do you have any other comments?

- Very good explanations and examples. Site visit was exciting
- It was fun and interesting
- The food was 10/10- Kiss to the chef

Annex

SecREEts

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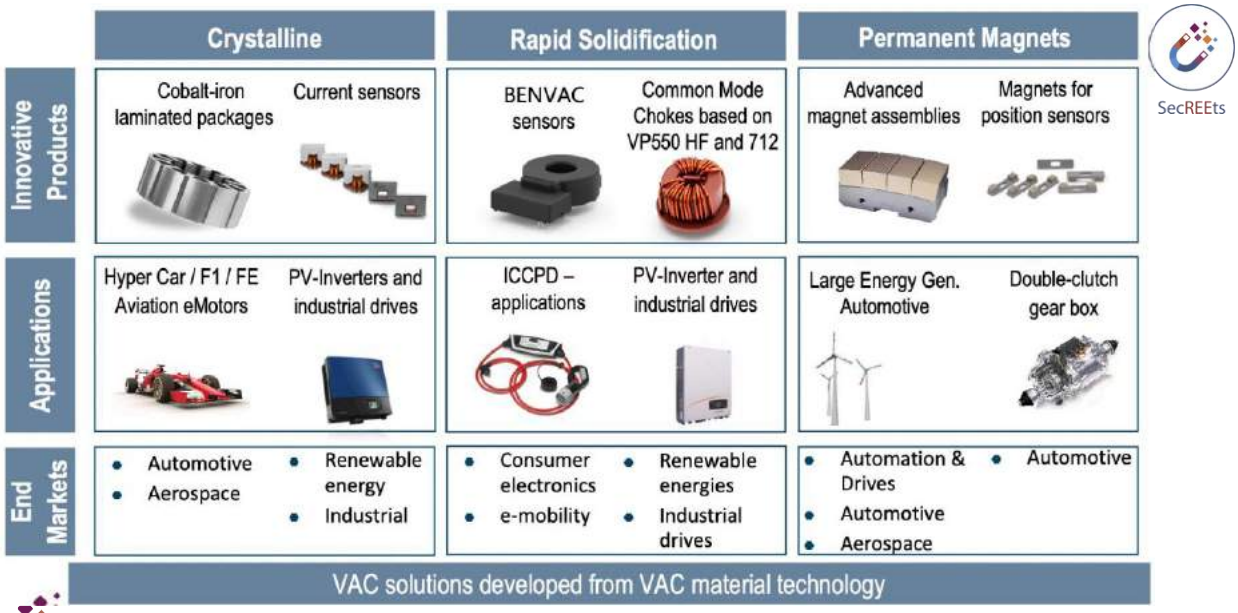

SecREEts

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In VACODYM (NdFeB Magnete) enthaltene Elemente

SecREEts

Atomradien (KZ 12) nach E. Hornbogen, H. Warlimont, Metallkunde

H .																	He .
Li 1,55	Be 1,12											B 0,98	C 0,914	N 0,92	O .	F .	Ne .
Na 1,90	Mg 1,60											Al 1,43	Si 1,32	P 1,28	S 1,27	Cl .	Ar .
K 2,35	Ca 1,97	Sc 1,62	Ti 1,47	V 1,34	Cr 1,27	Mn 1,26	Fe 1,26	Co 1,25	Ni 1,24	Cu 1,28	Zn 1,38	Ga 1,41	Ge 1,37	As 1,39	Se 1,40	Br .	Kr .
Rb 2,48	Sr 2,15	Y 1,80	Zr 1,60	Nb 1,46	Mo 1,39	Tc 1,36	Ru 1,34	Rh 1,34	Pd 1,37	Ag 1,44	Cd 1,54	In 1,66	Sn 1,62	Sb 1,59	Te 1,60	J .	Xe .
Cs 2,67	Ba 2,22	La 1,87	Hf 1,58	Ta 1,46	W 1,39	Re 1,37	Os 1,35	Ir 1,36	Pt 1,38	Au 1,44	Hg 1,57	Tl 1,71	Pb 1,75	Bi 1,7	Po 1,76	At .	Rn .
Fr	Ra	Ac															

14 Seltene Erdmetalle

Ce 1,81	Pr 1,82	Nd 1,82	Pm .	Sm 1,66	Eu 2,04	Gd 1,79	Tb 1,77	Dy 1,77	Ho 1,76	Er 1,75	Tm 1,74	Yb 1,92	Lu 1,74
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

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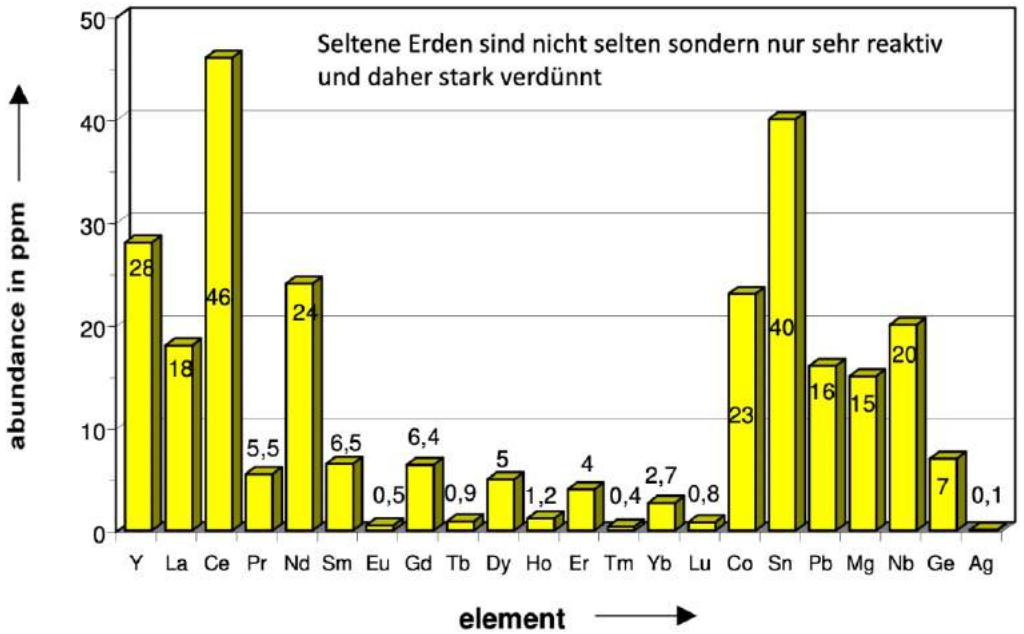

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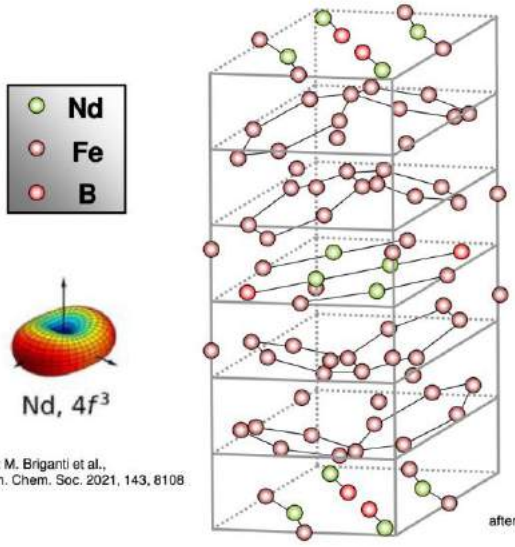
Kristallstruktur der intermetallischen $Nd_2Fe_{14}B$ Verbindung



Nd, $4f^3$

after: M. Briganti et al., J. Am. Chem. Soc. 2021, 143, 8108

after: J.F. Herbst and W.B. Yelon, J. Appl. Phys. **60** (1986) 4224

Nd ↔ alle Seltenen Erden, Dy, Tb, Pr	**Anisostropie macht die Magnete hart**
Fe ↔ Co	**macht die Magnete stark**
B	**stabilisiert die Kristallstrutur**

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Aufgabe 1

Welche der folgende Gegenstände enthalten Seltene Erden?

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Seltene Erden Magnete in Autos, neuerdings auch in Antriebsmotoren für EV

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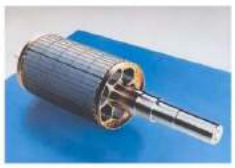
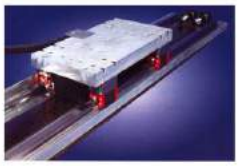
- Motoren



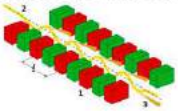


- Sensoren (Automobil)

Windkraft

Flugzeug-motoren

- Wissenschaftliche Anwendungen



XFEL Röntgenlaser

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VAC VACUUMSCHMELZE

Aufgabe 2: Seltene Erden auf der Welt - Vorkommen und Herausforderungen

SecREEts

- *In welchen Ländern der Welt werde, eurer Meinung nach, Seltene Erden hergestellt oder abgebaut?*

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VAC VACUUMSCHMELZE prospex

Aufgabe 2: Seltene Erden auf der Welt- Vorkommen und Herausforderungen

SecREEts

- *In welchen Ländern der Welt werden, eurer Meinung nach, Seltene Erden am häufigsten verwendet?*

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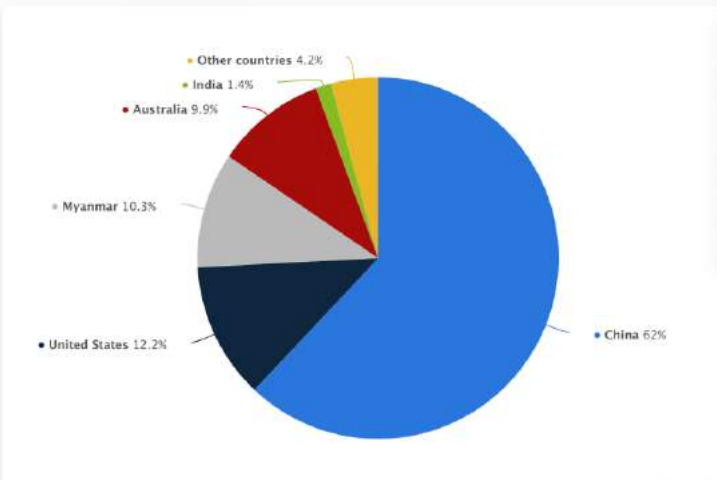
Verteilung der Produktion von Selten Erdern weltweit im Jahr 2019 nach ausgewählten Ländern

SecREEts



Source: https://www.statista.com/statistics/604345/distribution-of-rare-earth-element-production-worldwide-by-country/

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SecREEts

China stellt 98% der Lieferungen von Seltenen Erden an die EU.
Was bedeutet das?

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SecREEts

Secure European Critical Rare Earth Elements

Die Rolle von Vacuumschmelze

Dr. Matthias Katter, VAC

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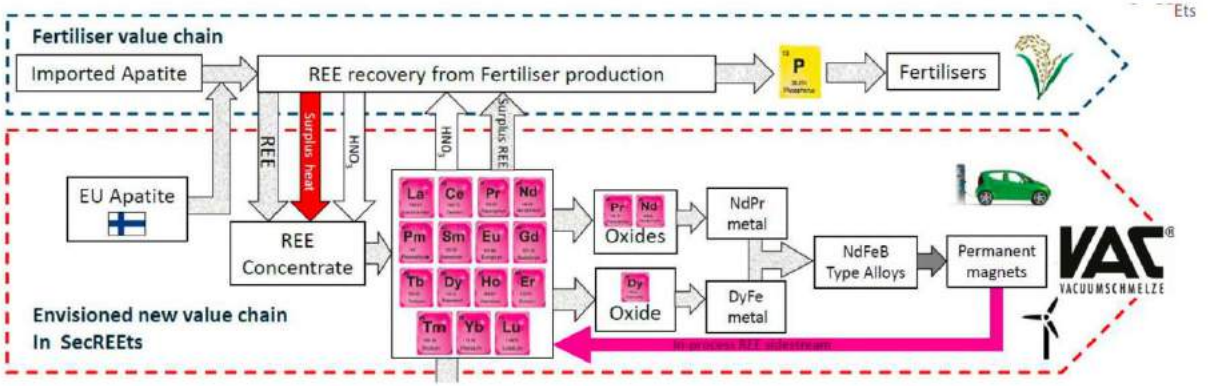
Rolle der VAC in SecREEts



- Kein zusätzlicher Bergbau für Seltene Erden
- Überschuss an SE geht zurück in die Düngemittelproduktion

➡ ökonomische und nachhaltige Versorgung von SE für Dauermagnete

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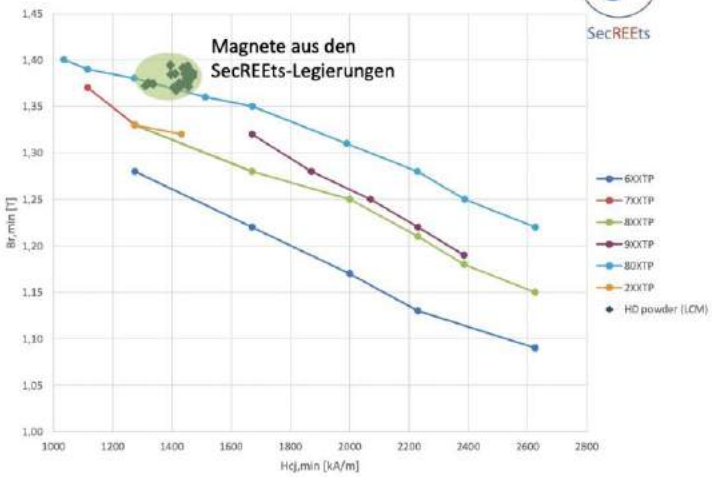
Vergleich mit Serienproduktion aus Chinesischen Rohstoffen

Legierungen erhalten von LCM



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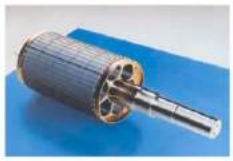
Anwendungen für SE-Magnete von VAC

- Motoren

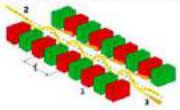


- Sensoren (Automobil)

Windkraft

Flugzeug-
motoren

- Wissenschaftliche Anwendungen



XFEL Röntgenlaser

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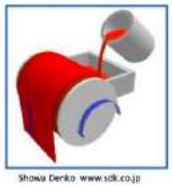
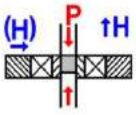
VAC

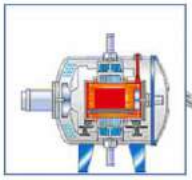
Pulvermetallurgische Herstellung von SE-Magneten



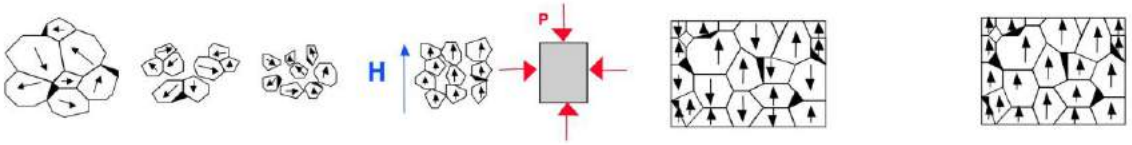
Showa Denko www.sdk.co.jp



die
pressing



melting under vacuum → coarse milling (HD) → fine milling → aligning & compaction: **CIP - AP - TP** → sintering & annealing → cutting, grinding & coating → magnetizing



isostatic
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VAC