

# SecREEEts Workshop



SecREEEts

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



CITIZEN LAB – Hanau

20 September 2022

Led by Prospex Institute  
With Vacuumschmelze

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## 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](http://www.secreets.eu)

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# Citizen Engagement in SecREEs

As part of the SecREEs Public Engagement strategy, Prospex Institute organises regular Citizen Labs to engage local communities in areas where industrial partners are established.

The last of a series of German Citizen Lab took place on 20 September 2022. Following the first online editions in 2021, this final meeting was held in person at Vacuumschmelze head quarter in Hanau.

Together with VAC and SINTEF, Prospex Institute introduced the latest updates on the SecREEs project to a group of local stakeholders. The project team used presentations, interactive exercises and question and answer sessions to help participants understand activities carried out in the project and discuss the potential for the SecREEs value chain 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 participant were also invited to a site visit of the Vacuumschmelze factory.

In accordance with the EU General Data Protection Regulation, participants were requested to fill in a registration form online ahead of the event, with personal information and consent for the processing of their personal data as part of the organisation and reporting of the activity

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# List of Abbreviations

- EV: Electric Vehicle
- PI: Prospex Institute
- RE: Rare Earths
- REE: Rare Earth Elements
- USA: United States of America
- VAC: Vacuumschmelze

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## 1 – Welcome and introductions

After welcoming participants to the session, lead moderator Katharina Faradsch from Prospex Institute (PI) stating that this Citizen Lab would focus on giving insights into the production of permanent magnets and the work conducted by Vacuumschmelze.

## 2 – *Presentation: Introducing Rare Earth Elements – Dr. Matthias Katter*

After the introductions Dr. Matthias Katter, Head of the R&D department for Permanent Magnets at Vacuumschmelze (VAC) took the floor. First he gave an introduction to Vacuumschmelze, proceeding then with a presentation on rare earths and their importance for different applications.

The full presentation can be found in the Annex.

## 3 – *Activity: How do we use Rare Earths?*

After VAC and the topic of REEs had been introduced to the audience, Katharina Faradsch proceeded with an ice-breaker exercise asking participants to introduce themselves and think of an example of a product of everyday life that they believed contains REEs.

### ***Following products were named:***

- Electric vehicle
- Headphones
- Mobile phone, EV, and many other items
- Hearing devices
- Wind Turbines
- MRI scanners

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.

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



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## 3 – Activity: Why run a project on REEs and permanent magnets?

Having clarified what REEs are used for and their omnipresence in everyday life products, Katharina Faradsch (PI) introduced the next exercise to the audience and asked a first of two questions:

### 1) “Which countries in the world have the largest deposits of REEs?”

Answers from the audience:

- China
- Nigeria
- Namibia
- Indonesia
- Brazil
- Bolivia
- USA

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After a short collection of the answers, Katharina follows up with a second question:

**2) Which countries manufacture the largest number of products containing REEs?”**

*Answers from the audience:*

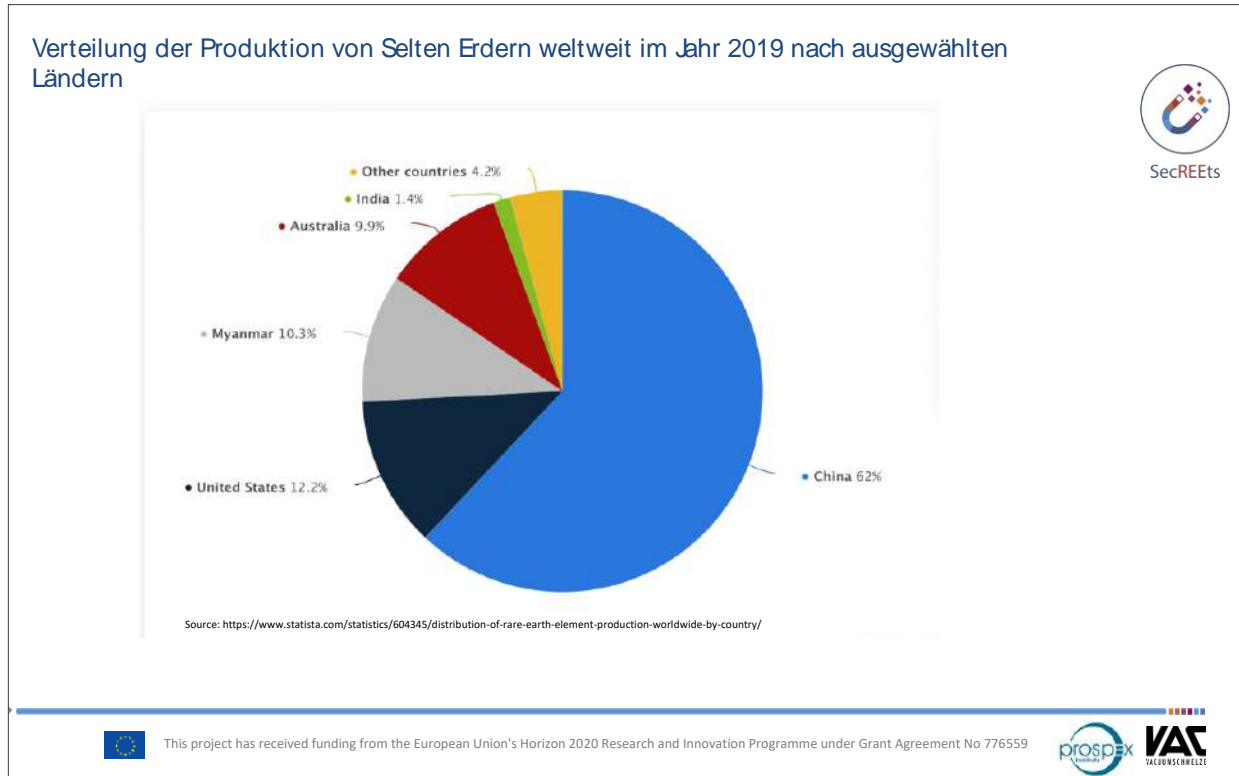
- *China*
- *Taiwan*
- *South Korea*
- *Israel*
- *France*
- *Germany*
- *United Kingdom*
- *USA*
- *Canada*

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



Katharina then invited Matthias Katter, Dominik Ohmer (VAC) and Arne Petter Ratvik (SINTEF) to comment and review participants answers.

Dr. Matthias Katter then showed an infographic depicting the distribution of REE production in the world.



#### 4 – Presentation: The SecREEs Project –Arne Petter Ratvik from SINTEF

Once the global context of REE production and its strategic importance was presented to the audience, Arne Petter Ratvik, Senior Scientist at SINTEF and SecREEs Project Leader, took the floor to introduce SecREEs to participants, including its objectives, the main elements of its value chain as well as the different pilot processes. Arne Ratvik also gave an update on the progress made in SecREEs over the past years.



## SecREEs Projektpartner und ihre Rolle:



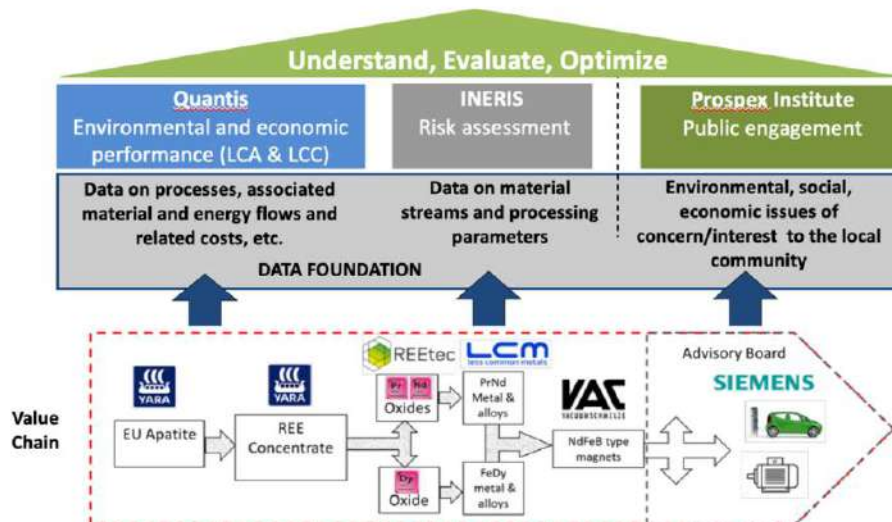
-  **SINTEF** ■ SINTEF AS – Norwegen, Koordinator
-  **YARA** ■ Yara International ASA – Norwegen
-  **LCM** ■ LESS COMMON METALS LIMITED - Groß Britannien
-  **REEttec** ■ REETEC AS - Norwegen
-  **Quantis** ■ QUANTIS - Schweiz
-  **VAC** ■ VACUUMSCHMELZE GMBH & CO KG - Deutschland
-  **PROSPEx** ■ PROSPEx INSTITUTE - Belgien
-  **INERIS** ■ INSTITUT NATIONAL DE L'ENVIRONNEMENT ET DES RISQUES (INERIS) - Frankreich



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## Sustainability and Risk, and Public Engagement

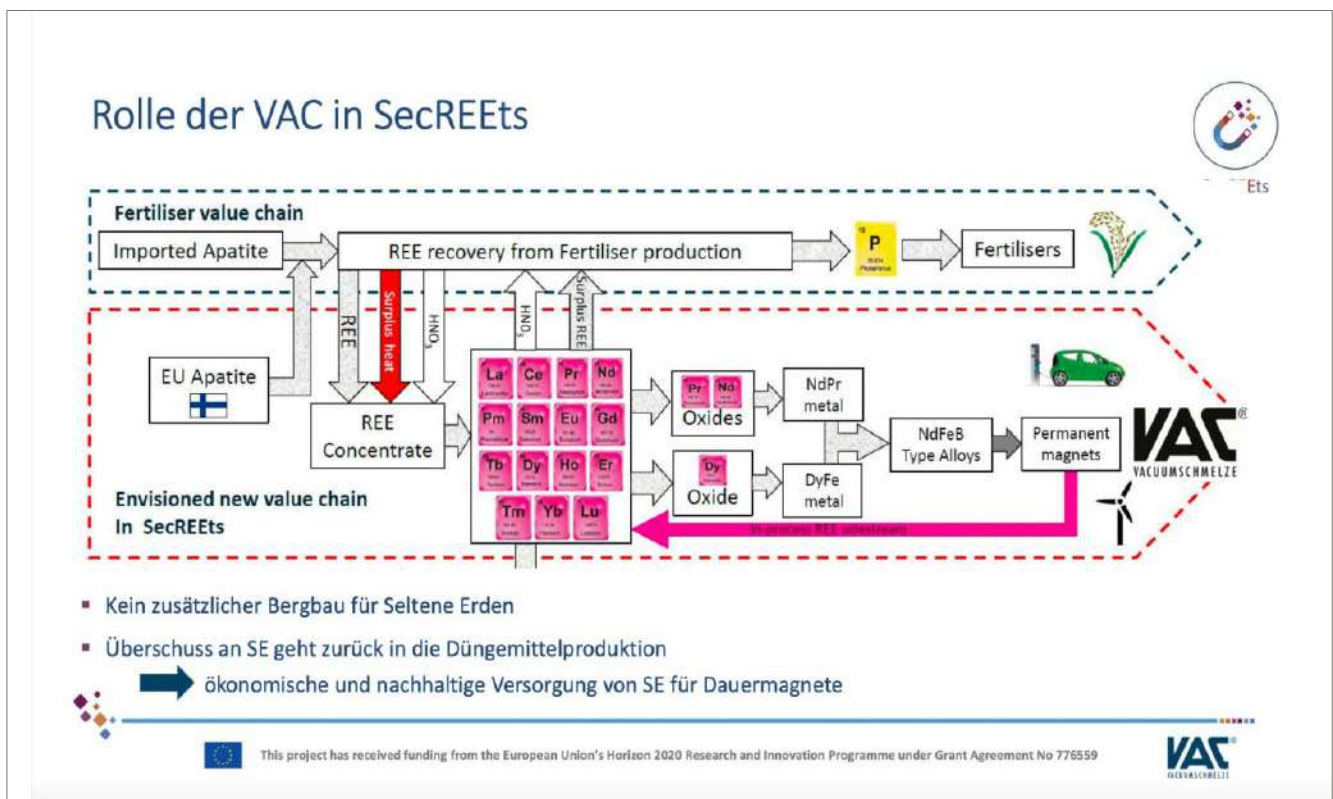


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## 5 – Presentation: What has happened at VAC? –Matthias Katter from Vacuumschmelze

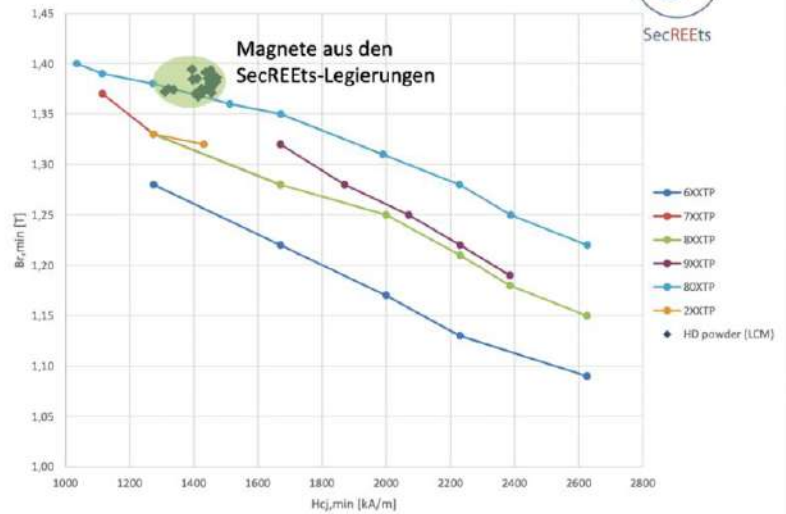
After the general presentation of the SecREEs project, Dr. Katter from Vacuumschmelze (VAC) provided more detailed insights on VAC's role in the SecREEs project, including their part of the value chains, and in particular their permanent magnet production. During its presentation Dr. Katter explained the types of products VAC manufactures, highlighting the strategic value of magnet manufacturing capacities in Germany. The slides from his presentation are available below:



## Vergleich mit Serienproduktion aus Chinesischen Rohstoffen

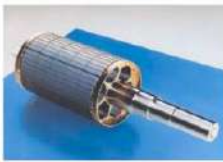


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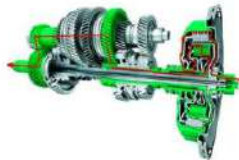


## Anwendungen für SE-Magnete von VAC

- Motoren



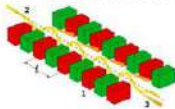
- Sensoren (Automobil)



Windkraft



- Wissenschaftliche Anwendungen



XFEL Röntgenlaser



Flugzeugmotoren



23/09/2022

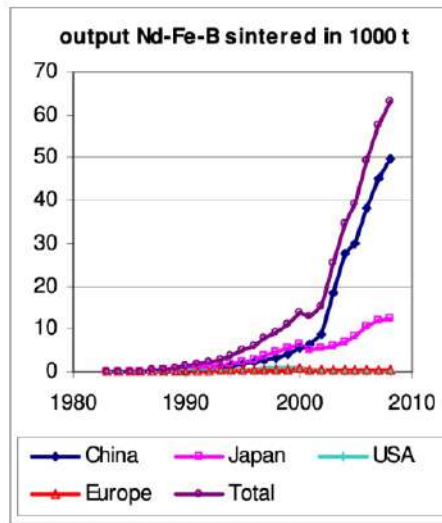
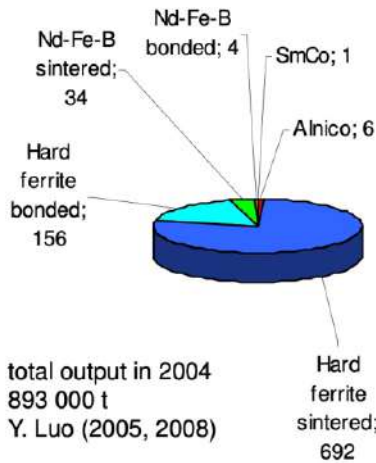


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## Produktion von SE-Magneten wird von China dominiert



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## Zusammenfassung und Ausblick



- Lange Zeit stand nur der Preis der Magnete im Vordergrund => Dominanz von China
- VAC konnte sich für Spezialanwendungen als praktisch einziger Anbieter in der westlichen Welt halten
- Neuerdings wegen großem Bedarf für die Elektromobilität Umdenken in Europa und USA
- Große Förderprogramme zum Neuaufbau einer Magnetindustrie in USA, Europa hinkt hinterher
- SecREEs leistet einen Beitrag die Wertschöpfungskette für SE-Magnete auch in Europa zu vervollständigen

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The presentation was followed by a question and answer session:

***Q: We have now seen the value chain starting from the raw material, but is there a possibility of creating recycling loops?***

**A:** Yes, recycling is indeed a theme and we do recycle here. However, we only carry out on-site recycling of our own production. There, we know what we have, what is inside of the materials. Everything that is produced here is recycled. There are a lot of scraps to recycle, but they cannot just be turned back into magnets, they have to be dissolved, reduced or separated to become raw materials again. We sell the ones we have, once they are stabilised, to China because there are the only companies that can process them. Then we bring the alloys or metals back from China, and there you have a loop. But that is only one part of the cycle, the other cycle is still complicated because all the magnets are installed somewhere, and if you want to use them, then you must get them out of the products, and there is still a lot of work ahead of us. All products (e.g. motors) need to be built in such a way that allows getting the magnets out with an effort that is smaller than the actual value of the material.

**A:** Another challenge of magnet-recycling is that there is very little recycled in relation to demand, the proportion is very, very small. There are several EU projects that have recycling as focus, such as [SUSMAGPRO](#), and [REEproduce](#).

## **7 – Wrap-up and site visit of Vacuumschmelze**

To conclude the event, Katharina Faradsch (PI) thanked the participants and speakers for their active contribution. Dr. Matthias Katter then proceeded to explain some safety measures and invited participants for a site visit of the VAC factory.



Site visit of Vacuumschmelze factory

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# Evaluations

Participants were handed evaluation forms to fill in at the end of the meeting. These evaluations are designed to help the SecREETs team get feedback on their public engagement policy and the Citizen Lab more specifically.

The participants were asked to answer the following questions:

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

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

### *Comments*

- *No comments*

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

<i>Please mark</i>	Very much	Much	Somewhat	Little	Very Little	No opinion
<i>Number of answers</i>	2	2	0	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?

<i>Please mark</i>	Very much	Much	Somewhat	Little	Very Little	No opinion
<i>Number of answers</i>	1	2	0	0	0	1

### *Comments*

- *No comments*

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

<i>Please mark</i>	Very much	Much	Somewhat	Little	Very Little	No opinion
<i>Number of answers</i>	2	1	1	0	0	0

*Comments:*  
- No comments

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

<i>Please mark</i>	Very good	Good	OK	Bad	Very bad	No opinion
<i>Number of answers</i>	4	0	0	0	0	0

*Comments:*  
- Very good and complete overview

#### Do you have any other comments or remarks?

- An exchange with actual decision-makers would certainly also be appropriate.



# Annex



**SecREETS**  
Secure European Critical Rare Earth Elements

## Citizen Lab Einführung zur VAC

20.09.2022 in Hanau  
Dr. Matthias Katter  
VACUUMSCHMELZE GMBH & CO. KG

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### Ihr Partner für hochentwickelte magnetische Lösungen



**Der Magnetismus ist unsere Heimat**

Wir treiben die Technologien von heute und morgen mit Leidenschaft voran. Als zuverlässiger Partner entwickeln wir mit unseren Kunden Anwendungslösungen, die es ermöglichen, den ständig steigenden Anforderungen gerecht zu werden. Mit bahnbrechenden Lösungen gehen wir an technische Grenzen. Der Einsatz unserer Materialien und ihre besonderen magnetischen Eigenschaften sind der Schlüssel, um die Lösungen unserer Kunden kleiner, leichter, effizienter und nicht zuletzt sicherer zu machen.

<b>500+</b> Kundenspezifische Lösungen	<b>170+</b> Legierungen	<b>4.000</b> Mitarbeiter
<b>2.000+</b> Aktive Kunden		<b>500+</b> Patente

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# Branchen in denen VAC aktiv ist















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SecREEs

	Crystalline	Rapid Solidification	Permanent Magnets
Innovative Products	Cobalt-iron laminated packages  Current sensors 	BENVAC sensors  Common Mode Chokes based on VP550 HF and 712 	Advanced magnet assemblies  Magnets for position sensors 
Applications	Hyper Car / F1 / FE Aviation eMotors  PV-Inverters and industrial drives 	ICCPD – applications  PV-Inverter and industrial drives 	Large Energy Gen. Automotive  Double-clutch gear box 
End Markets	<ul style="list-style-type: none"> <li>Automotive</li> <li>Aerospace</li> <li>Renewable energy</li> <li>Industrial</li> </ul>	<ul style="list-style-type: none"> <li>Consumer electronics</li> <li>e-mobility</li> <li>Renewable energies</li> <li>Industrial drives</li> </ul>	<ul style="list-style-type: none"> <li>Automation &amp; Drives</li> <li>Automotive</li> <li>Aerospace</li> <li>Automotive</li> </ul>

VAC solutions developed from VAC material technology

21/10/2022



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# In VACODYM (NdFeB Magnete) enthaltene Elemente



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

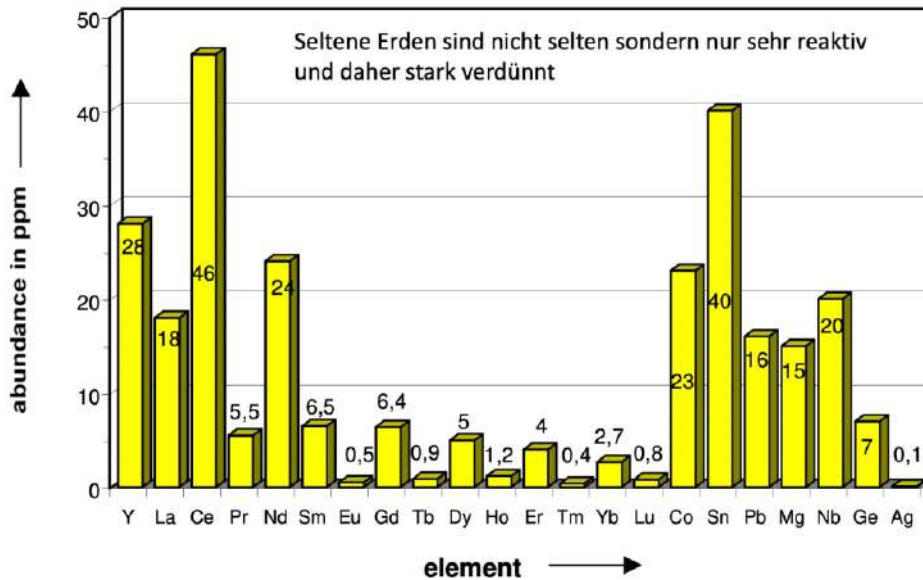
Ce 1,81	Pr 1,82	Nd 1,82	Pm .	Sm 1,66	Eu 2,04	Gd 1,79	Tb 1,77	Dy 1,77	Ho 1,76	Er 1,75	Tm 1,74	Yb 1,92	Lu 1,74
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr



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## Verwendung von Seltenen Erden als farbige Leuchtstoffe, z.B. in LED- und Energiesparlampen



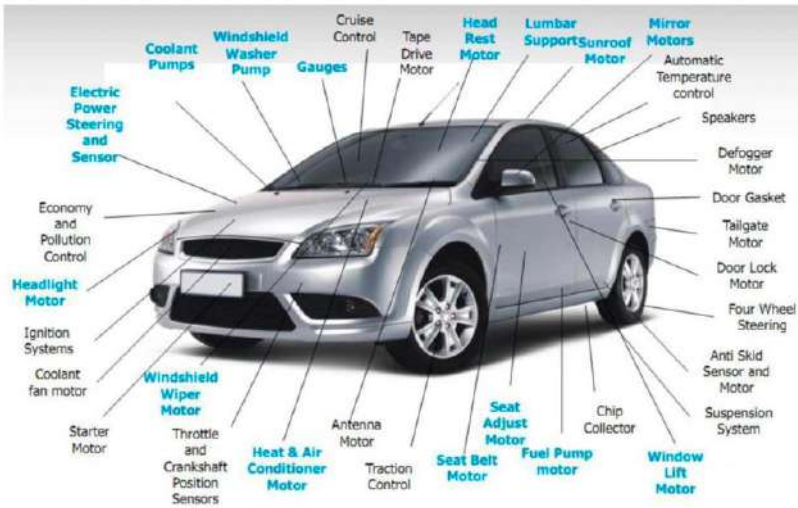
21/10/2022



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



**A BREAKDOWN OF THE CRITICAL METALS IN A SMARTPHONE**

Some vital metals used by both of these devices are considered at risk due to potential scarcity, geopolitical issues or trade policy. This infographic details the critical metals that you carry in your pocket.

**TOUCH SCREEN**  
In

**MICROPHONE, SPEAKERS, VIBRATION UNIT**  
Nd, Pr, Dy, Gd, Tb

**DISPLAY**  
The display screen uses various metals. Some of the critical metals used in the display are: La, Pr, Eu, Gd, Tb, Dy

**ELECTRONICS**  
Metals in critical electronic components include: Ni, Ga, Ta, Cu, Ni, Pr, Nd, Gd, Tb, Dy

**CASING**  
Metals in critical electronic components include: Mg, Ni

**BATTERY**  
The majority of smartphones use lithium ion batteries. Li, Co, Ni

**ELEMENTS**  
www.elements.com

**Why live in a material world.**



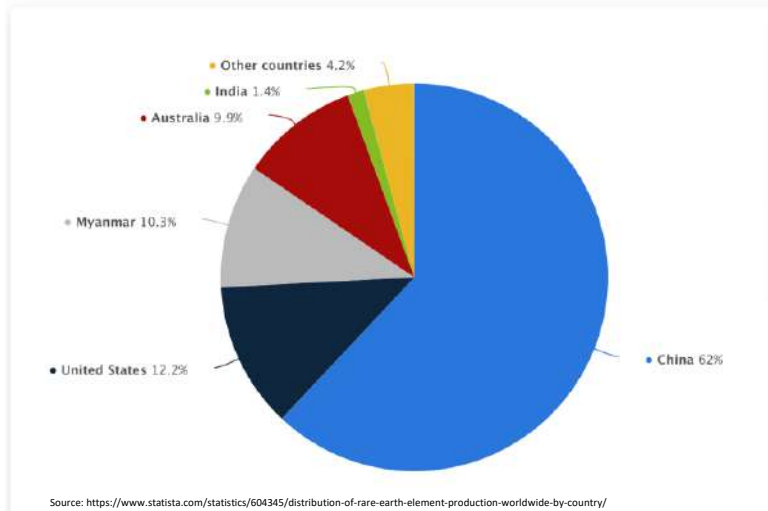
21/10/2022



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## Verteilung der Produktion von Seltenen Erden weltweit im Jahr 2019 nach ausgewählten Ländern



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SecREEs

Secure European Critical Rare Earth Elements

## Die Rolle von Vacuumschmelze

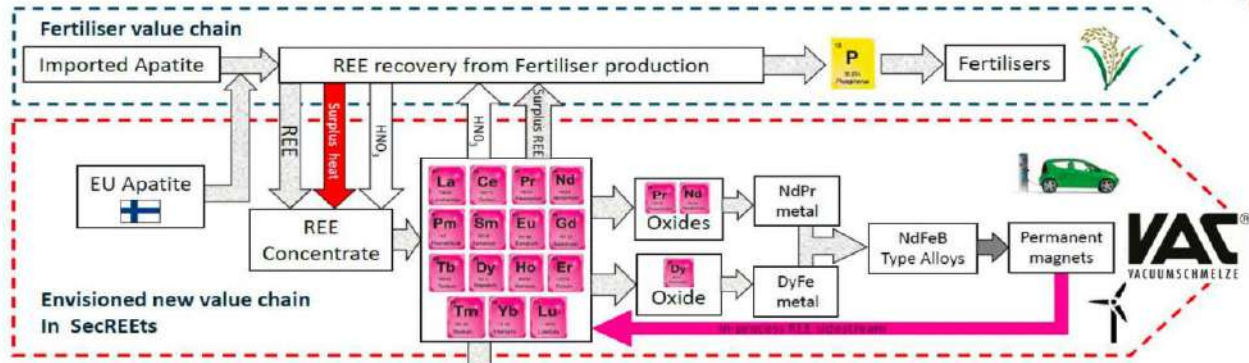
Dr. Matthias Katter, VAC



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# Rolle der VAC in SecREEs



- Kein zusätzlicher Bergbau für Seltene Erden
  - Überschuss an SE geht zurück in die Düngemittelproduktion
- ➔ ökonomische und nachhaltige Versorgung von SE für Dauermagnete

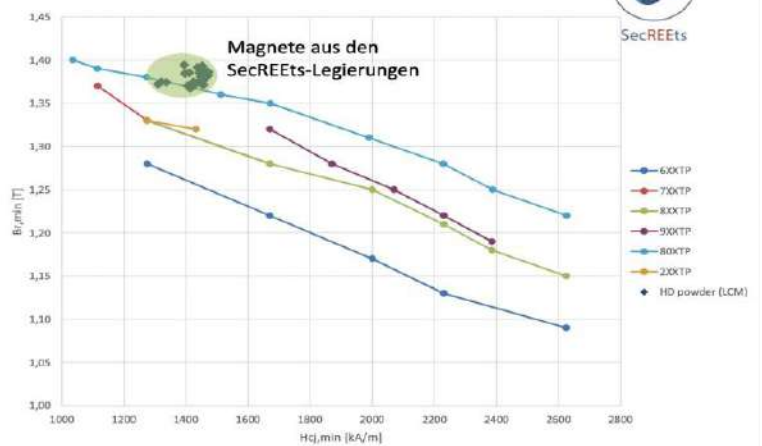
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# Vergleich mit Serienproduktion aus Chinesischen Rohstoffen



Legierungen erhalten von LCM



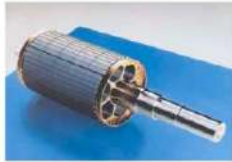
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## Anwendungen für SE-Magnete von VAC

- Motoren



- Sensoren (Automobil)



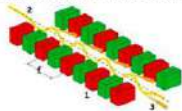
Windkraft



Flugzeug-  
motoren



- Wissenschaftliche Anwendungen



XFEL Röntgenlaser

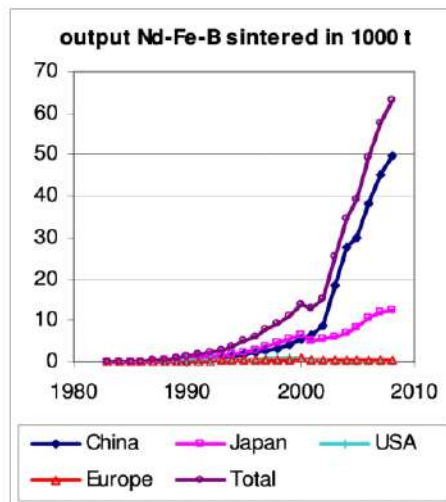
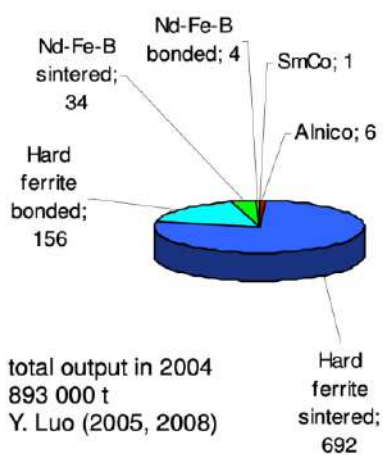
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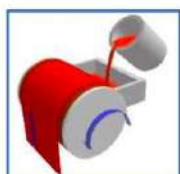
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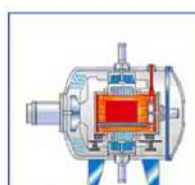
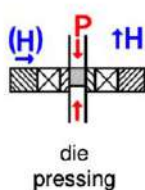
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## Pulvermetallurgische Herstellung von SE-Magneten



Shofu Denko www.sdf.co.jp



melting  
under  
vacuum

coarse  
milling  
(HD)

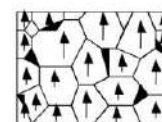
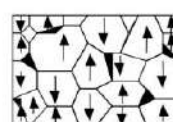
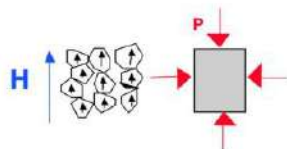
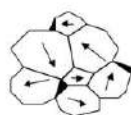
fine  
milling

aligning &  
compaction:  
CIP - AP - TP

sintering &  
annealing

cutting,  
grinding &  
coating

magnetizing



21/10/2022



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