



# Scandium (Vanadium, Niobium) for the European Industries from $\text{TiO}_2$ pigment production residues

2021-2024, 3.5 M€ total budget including co-funding

## Consortium



Raw Material Provider: Kronos Ecochem, Leverkusen, Germany

# Scandium is one of the key elements for Energy Transition and C-Footprint reduction

## ScaVanger Innovation

- ✓ Rapid near-real time in-situ processing of scandium hydroxides from aqueous iron-chlorine rich solutions
- ✓ Full water recycling during processing
- ✓ First producer of tailor made AlSc alloys for thin film deposition for 5G, and ScF3 for AlSc Master alloy manufacturers.

# ScaVanger's Stakeholders and advisers

## on Europe's growing SCANDIUM markets

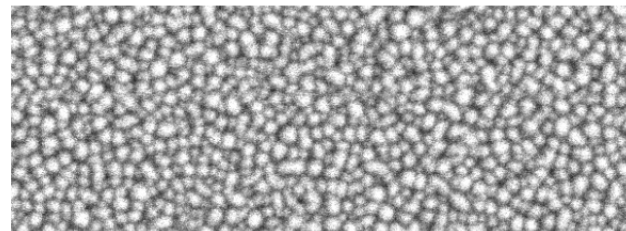


13 May 2022 | Cristina Brooks

Solid Oxygen Fuel Cells (SOFC)  
Solid Oxygen Electrolyzer Cells (SOEC)



**SOLMATES**  
THIN FILM EQUIPMENT  
A Lam Research Company



AlScN Thin Films for  
5G applications

**Solid oxygen fuel cells (SOFC)**, where scandium is used in cathode materials, and for green hydrogen production in **solid oxide electrolyser cells (SOEC)**. SUNFIRE ([www.sunfire.de](http://www.sunfire.de)) advises ScaVanger

**Light weight AlSc alloys** reducing weight of aircrafts. Scandium addition to Al is beneficial for grain refinement during casting and welding, precipitation hardening and grain structure control, and 3D printing)

ScaVanger is advised by leading companies in the aeronautic industries covering the entire value chain from Master alloy producers *KBM Affilips* (NL) [www.kbmaffilips.com/](http://www.kbmaffilips.com/)), to AlSc sheet and plates for the aircrafts by *NOVELIS Deutschland*. [www.novelis.com/aerospace](http://www.novelis.com/aerospace)), up to the endusers *Airbus Defense* (DE) [www.airbus.com](http://www.airbus.com)) and *Sonaca* (B; [www.sonaca-aircraft.com/](http://www.sonaca-aircraft.com/)).

**Thin films for high frequency band-filters in 5 G** applications as AlScN, SOLMATES (NL) [www.solmates-pld.com/markets/scain-for-rf-mems/](http://www.solmates-pld.com/markets/scain-for-rf-mems/) advises ScaVanger.

The **Sc market** is forecasted to increase from 25 tons per year  $\text{Sc}_2\text{O}_3$  in 2020 to 350 tons per year in 2026 and 1,100 tons per year in 2031.

**Today**, the EU imports 100 %, mainly from China (~67 %) as Sc oxide ( $\text{Sc}_2\text{O}_3$ ). Small-scale AlSc alloy production (~1 ton per year) is performed at KBM-Affilips (NL).

**Today**, there is no scandium production in Europe.



EIT RM ScaVanger Project

TiO<sub>2</sub> producers:

KRONOS, TRONOX:

1.5 million tons/year

EIT RM Scaleup Project

Aluminium producer

MYTILINEOS 7-8 million tons/year

Bauxite Residues

Total Scandium  
Production for EU

equivalent Sc<sub>2</sub>O<sub>3</sub>: 45 tpy > 2025





## ScaVanger Company's VISION (> 2025)

First Scandium producer in Europe providing continuously eq. 21 t  $\text{Sc}_2\text{O}_3/\text{a}$  at competitive prices.

## ScaVanger Company's MISSION

- reuse metallurgical residues for rare and critical metal extraction
- supply Sc hydroxides for the Sc refining industries
- supply tailor made Sc products to the European's growing industries
- Co-produce vanadium pentoxides, vanadium salts and niobium alloys.

## ScaVanger Project (2021-2024): MISSION

- Upscaling Sc extraction and refining processes from iron-rich chlorine solution produced by  $\text{TiO}_2$  pigment production plants.
- Upscaling vanadium (V) and niobium (Nb) coproduction from the residual solutions.

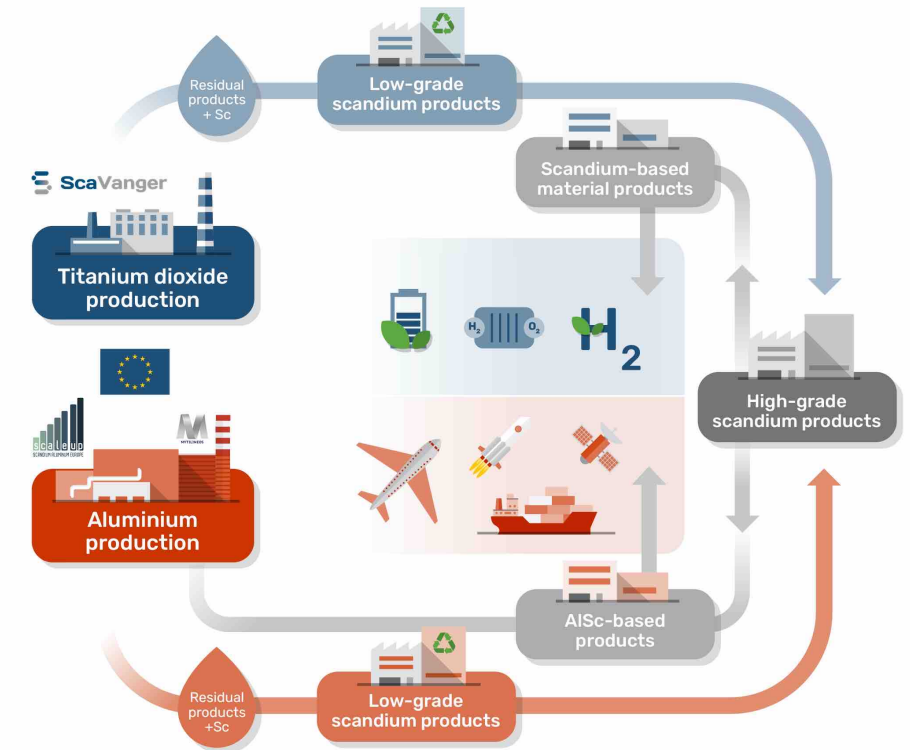
Solvent Extraction - Ion Exchange - Al thermo reduction

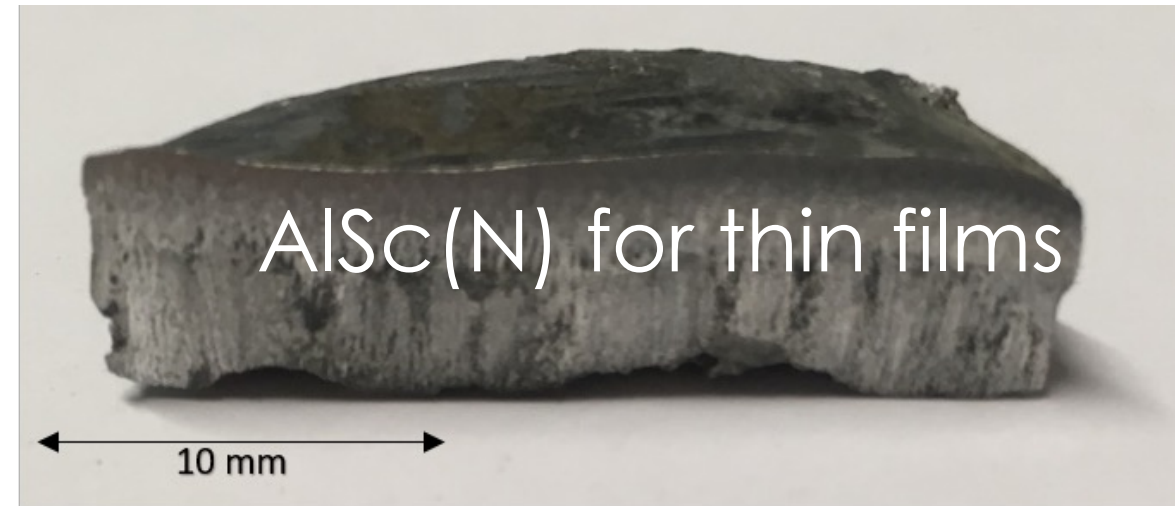
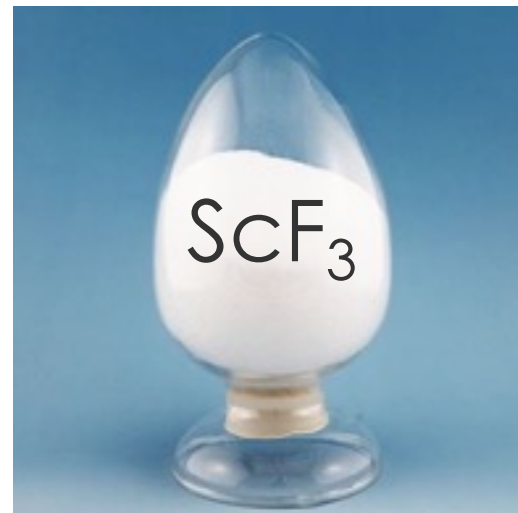
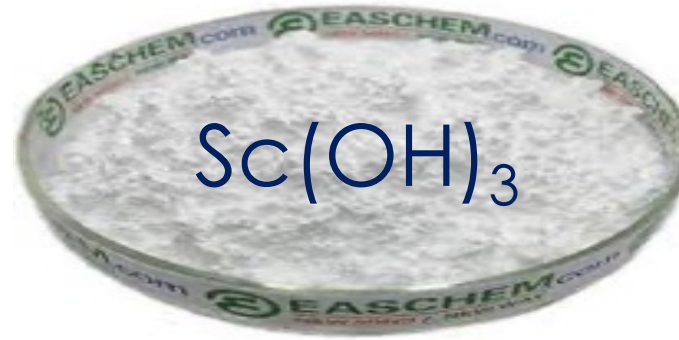


# ScaVanger Company's Strategy

- KRONOS Ecochem (DE) provides the FeCl rich solutions to the ScaVanger Sc-hydroxide production plant.
- Providing intermediate and customized Sc products:  
Sc-oxyhydroxides, AlSc-alloys at variable Sc contents, ScF<sub>3</sub> for our « first- row » stakeholders, our advisers.
- The first plant will be operated by the ScaVanger company at an EU TiO<sub>2</sub> producer site and can then be adapted to 5 EU chlorine TiO<sub>2</sub> production sites.
- Buying Sc-hydroxides derived from Al-production residues at MYTILEONOS Greece (EIT Raw Material Scaleup Project (2022-2025) to increase the refining capacity (EIT Scaleup project: [www.scaletechnology.eu](http://www.scaletechnology.eu))
- Selling Sc products at competitive prices. Target price (Sc<sub>2</sub>O<sub>3</sub>): below or equivalent to Chinese products (at present <1000 US\$/kg).

## European Scandium for a Lighter and Greener Future





## ScaVanger Products

## ACHIEVEMENTS September 2022:

- SX Piloting Sc extraction from  $\text{FeCl}_2$ : 130 mg/L Sc
- Strip liquor product from pilot operation 3.5 g/L Sc (further Sc increase possible)
- Efficiency > 90 %
- Fe removal from Sc-bearing strip liquor: successful > 95%

## Ongoing:

- IX Labtests: evaluation & decision-making for IX pilot
- Refining of Al
- Vanadium-production tests and decision making



## To-do's:

- ❖ IX piloting (01/2023)
- ❖ Definition of industrial requirements (Q4/2022)
- ❖ Plant design for pre-industrial and industrial Sc production (2023)
- ❖ V production (2023)
- ❖ AlSc production for thin film deposition (2023)
- ❖ Nb-alloy production (2023)
- ❖ Webseminar (Q4/2022) in progress

**=> GO-TO-MARKET 2024-2025**

## HOW DOES EIT SUPPORT THE PROJECT?

1. **Cofunding:** 70 % of the total budget
2. **Push and guide us to focus on « Go-To-Market »:** developing strategies, review meetings, organizing events (annual: EIT summits EIT expert forums, EIT Partner Days, clustering events...) to increase stakeholder's network and help to implementing exchange at EU but also outside EU levels (ERMA-Quebec meetings etc..)
3. **Importance of Project Officer and Senior Advisers of the project:** help and contribute Indispensable for good functioning: informing the PO and SA, exchanging with them, inviting them to project events, asking for help.
4. **Facilitator for company set-up through ERMA**
5. **Creating task forces on 'hot RawMaterial topics' for EU: E.G.** Fuel cells and electrolyzer....: participating of project partners increase network for stakeholder.



### ScaVanger employs and trains:

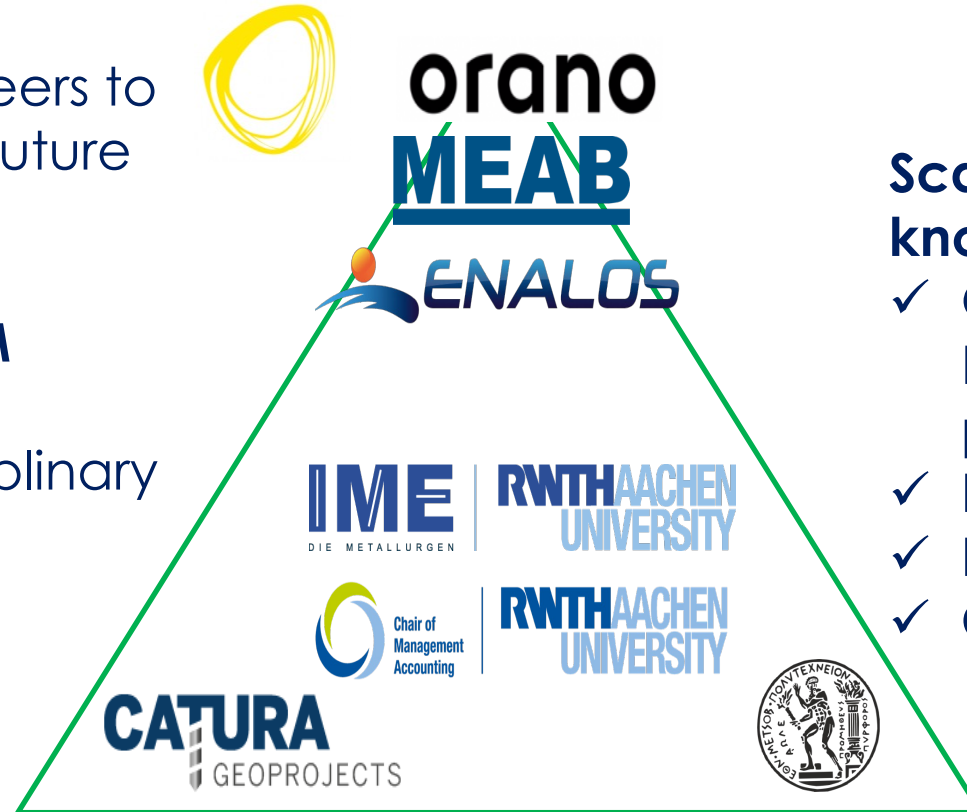
- ✓ MSC, PhD students,
- ✓ young researcher, engineers to build knowledge for the future business

### Advantage to work in EIT RM projects:

- ✓ Being part of a transdisciplinary consortia,
- ✓ learning all aspects from research to business.

**INTEGRATION**

**INDUSTRIE**



**Strong Support from:**  
**KRONOS Leverkusen (DE)**  
**Airbus, Sonaca, Novelis, KBM,**  
**Sunfire, Imerys, Solmates**

### ScaVanger transfers knowledge:

- ✓ Organize webseminars for BSc, MSc, PhD students on projects relevant topics.
- ✓ Present on conferences
- ✓ Publishes
- ✓ Cluster with other projects



[www.scavanger.eu](http://www.scavanger.eu); [www.scaletechnology.eu](http://www.scaletechnology.eu)