

For submission to European Climate Pact website

## European Scandium for a Lighter and Greener Future

### What is scandium and how is it used?

Scandium (Sc) is a very light metal, almost as light as aluminium, but with a higher melting point. That makes it interesting for many applications.

Scandium is increasingly used in energy storage systems such as solid oxygen fuel cells (SOFC) and for green hydrogen production in solid oxide electrolyzer cells (SOEC). Scandium is also increasingly used in the aluminium production and refining industries for manufacturing light-weight alloys such as AlMgSc sheets for marine and space constructions, Liquefied Petroleum Gas (LPG) container vessels, windmill blades and for 3D printing. AlScN piezoelectric films for energy generation are important compounds for 5G applications.

So, Aluminium-scandium alloys, scandium oxides and fluorides can play a major role for our energy transition and innovative technologies to reduce CO<sub>2</sub> footprints.

The scandium market is expected to increase from 25 tons per year Sc<sub>2</sub>O<sub>3</sub> in 2020 to 350 tons per year in 2026 and 1,100 tons per year in 2031.

### Where do we get scandium from?

In nature, scandium is not rare, but can be found only as traces in minerals. So, scandium is mainly recovered as by-product from uranium production residues. The above-mentioned applications need different types and qualities of scandium products. Today, the EU imports 100 %, mainly from China (~67 %) as scandium oxide (Sc<sub>2</sub>O<sub>3</sub>). Small-scale aluminium-scandium alloy production (~1 ton per year) is performed at KBM-Affilips (NL). Currently, there is no scandium production in Europe.

Therefore, a continuous supply of scandium at reasonable prices must be ensured in and for Europe, and the dependency from China must be reduced. Europe is leading in the development of green technologies and has sufficient scandium resources.

These resources indeed are presently locked in metallurgical residues. They are hosted in residual iron-chloride solutions from titanium oxide (TiO<sub>2</sub>) pigment production. Each year, about 1.5 million tons of TiO<sub>2</sub> are manufactured in Germany, the Netherlands and the United Kingdom. The iron chloride-rich solutions are either neutralized and landfilled, or, in some plants, sold as a product to the chemical industry for industrial waste water treatment.

Scandium will be extracted through hydrometallurgical processing “in-line” from acid residual solutions during metallurgical processing of the titanium dioxide. The ScaVanger’s ecological and economical processing includes acid and water recycling, as well as metal recoveries during the cleaning process. This converts residue to valuable products – economically and ecologically-friendly.

Significant scandium resources are also hosted in residue from the alumina production. Each year, 7 to 8 million tons of alumina are produced in Europe, generating 6-7 million tons of this residue. Approximately only 1-2 kilo tons of the residue is recycled in construction materials, such as cement. Demonstration in 2020 at the MYTILINEOS alumina plant (Greece) proved scandium hydroxide production at semi-industrial scale (EU-funded H2020 Scale project: [www.scaletechnology.eu](http://www.scaletechnology.eu)).

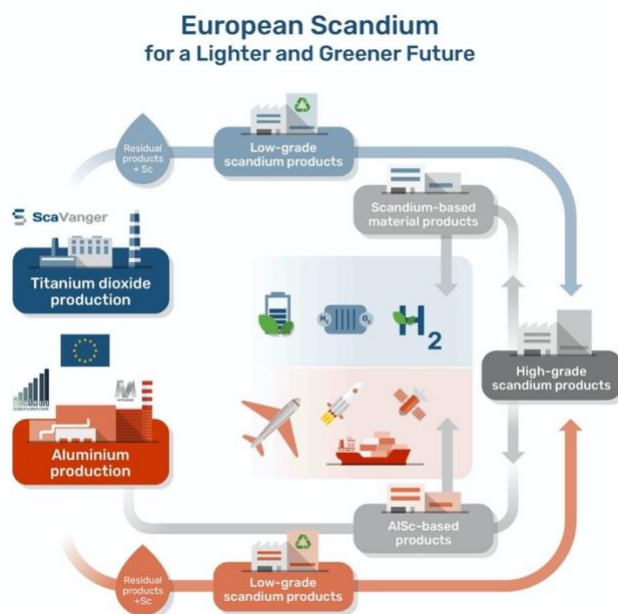
## Scandium production in and for Europe

Europe can become a leader in the growing market applications covering the entire value chain when a continuous scandium supply is ensured. Europe's tradition in extractive metallurgy provides the know-how and experience of scandium production.

The recently funded EIT projects (total budget 6 million €) **ScaVanger** (2021–2024) and **Scaleup** (2022–2024) will bring 3 scandium products to the market.

1. Scandium hydroxides.
2. Scandium oxides and scandium fluorides corresponding to about 45 tons per year equivalent to scandium oxide for the European market.
3. AlSc alloys in mass production to supply small-scale specialized AlScMg producers.

Upscaling of metallurgical processing to preindustrial production will be performed for 3 years from both resources: iron-rich chloride solutions ( $\text{TiO}_2$  production at a site in the EU) and residue (alumina production at MYTILINEOS S.A, Greece). This scandium production will start up-ramping in 2025. The concepts can be adapted and exported to other  $\text{TiO}_2$  and Al processing plants in and outside the EU.





## Partners ScaVanger



## Partners Scaleup



The **ScaVanger** and **Scaleup** projects are co-funded by EIT Raw Materials (<https://eitrawmaterials.eu/>)

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