

SUSTAINABLE PRODUCTION OF SCANDIUM PRODUCTS IN EUROPE

By

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ABSTRACT

Scandium is a metal with increasing demand due to its application in production of high strength, light-weight aluminium scandium alloys for the aerospace industry as well as its use in solid oxide fuel cells (SOFCs) and solid oxide electrolyser cells (SOECs). Currently, China accounts for 66% of the world annual production of scandium and the remainder being produced by Russia and Kazakhstan. Research has been on-going to develop a sustainable process for the recovery of scandium from Europe's mining and metallurgical waste streams, particularly the bauxite residue from the alumina industry and acid waste from the titania production industry. The ongoing SCALEUP and SCAVANGER projects, funded by the European Institute of Innovation and Technology (E.I.T. raw materials) are follow-ups to the SCALE project, which was funded by the European Union Horizon 2020 programme.

The SCALE project demonstrated on bench scale the use of hydrometallurgical techniques such as acidic leaching, ion exchange, solvent extraction and crystallization to produce an ammonium scandium hexafluoride product, which can be further calcined into ScF_3 and Sc_2O_3 products of purity > 99%. The ScF_3 can also be used to produce aluminium scandium master alloy containing 2% scandium. This was accomplished at Technology Readiness Level (TRL) 6 using typical waste resources from Europe's alumina and titania industries.

The SCALEUP project will further demonstrate and optimize the flowsheet developed under the SCALE project to recover scandium from bauxite residue while the SCAVANGER project will demonstrate and optimize the flowsheet for recovery of scandium from titanium dioxide acid waste in light of commercialization. This will pave way for commercial implementation to become the first full-scale production of scandium products of high purity to meet Europe's scandium demand for the aerospace, machinery as well as the SOFCs and SOECs industries. This will reduce the dependence of Europe on Chinese scandium products since China has been dominating the market for scandium and other rare earth metal products. Scandium production from bauxite residues and titanium dioxide pigment production residues is expected to start in Europe in the foreseeable future.

Keywords: scandium, hydrometallurgy, leaching, solvent extraction, crystallization, ScF_3 , Sc_2O_3 , aluminium scandium alloy