



JX Nippon Mining & Metals

June 8, 2022

JX Nippon Mining & Metals Corporation

TANI OBIS GmbH collaborates with Volkswagen-led research team to advance battery-recycling technology

Our group company, TANI OBIS GmbH (CEO: Kazuhiko Iida; “TANI OBIS”)^{*1} and Partners from business and science want to jointly prove that the most valuable components of drive batteries can be recovered and reused several times in succession through recycling. The "HVBatCycle" research consortium aims to permanently manage cathode metals, electrolyte and graphite in a closed material cycle. Under the leadership of the Volkswagen Group, TANI OBIS GmbH, J. Schmalz GmbH, Viscom AG have been working together with researchers from RWTH Aachen University, TU Braunschweig and the Fraunhofer Institute for Surface Engineering and Thin Films for three years on researching and developing the processes required for this. The project is funded by the Federal Ministry for Economic Affairs and Climate Action.

Michael Kellner, Parliamentary State Secretary: “European battery production can only be successful if it focuses on sustainability in as many areas as possible. Sustainable batteries are crucial for an energy and transport transition that is based on high environmental and social standards.”

Sebastian Wolf, Chief Operating Officer Battery Volkswagen AG, explained: “The recycling of batteries and production scraps make a crucial contribution to ensuring the supply of raw materials to our planned factories. The HVBatCycle project is preparing a holistic view of the recycling processes and thus the implementation of the closed loop of battery materials.”

Kazuhiko Iida, CEO of TANI OBIS GmbH states: “We are honored to make a collaboration partnership with trustworthy partners in the LiB recycling business. Through this partnership between industry, government, and academia, JX Metals group aims at early commercialization of LiB recycling.”

Dr. Shizuo Sugawara, Deputy CEO of JX Nippon Mining and Metals explains: “JX Metals group has been working on the development of recycling technology to establish “closed-loop recycling”, the circular process to recycle valuable metals from used LiBs to the raw materials for new ones, and our group has already developed the technology that can extract metallic salts for raw materials of LiBs. At this time, we took a further step to develop the early commercialization in the EU region, where industry, government, and academia are proactively accelerating EV shift.”

Dr. Kazuyuki Marukawa, Vice Chairman of TANI OBIS GmbH and CEO of JX Metals Circular Solutions Europe GmbH^{*2}, adds: “We unitedly contribute to the success of the project. We will newly establish a hydrometallurgical plant for the upcoming R&D based upon our technologies in Goslar, where TANI OBIS operates its main facility. In this project, we play a key role to optimize the recycling processes to recover the high-quality materials with high yields, inputting black mass (pulverized batteries) provided by Volkswagen AG. Starting up with EU and Germany together with Volkswagen-led research team, JX Metals group will globally contribute to the early spread of EVs which are indispensable for the realization of a carbon-free society and the realization of a resource-recycling society through the foregoing efforts.”

Closed raw material cycle and multiple recycling

In order to use less materials from primary sources such as mines or salars, essential raw materials should not only be recovered once, but several times. For this purpose, battery cells made from recycled material are recycled again in order to prove that even multiple recycling runs have no impact on the material quality. Closing the cycle requires complex interdisciplinary processes. For efficient, ecologically and economically useful recycling, all processes must be coordinated with one another to produce single-variety, high-quality secondary materials with the highest safety requirements. In particular, this involves scalability and cost-effectiveness.

Advantages through the use of secondary materials

The consortium project focuses on the mechanical-hydrometallurgical recycling route, which is characterized by low energy requirements. The "HVBatCycle" project is intended to show efficient processes and innovative solutions that ensure the development of an end-to-end value chain with high profitability and at the same time the highest possible recycling and energy efficiency and minimal environmental pollution.

Automation of the dismantling processes and recovery of the electrode material

Concrete innovative development approaches lie in need-based, i.e. economically optimized discharge and a largely automated dismantling of declining battery systems down to the cell or electrode level. This also includes an almost loss-free separation of active material and carrier foils as well as the recovery of graphite and volatile electrolyte components.

In the subsequent hydrometallurgical processing of the "black mass" of graphite and battery metals using water and chemical solvents, the focus is on an early and selective extraction of the lithium in soluble form as well as the leaching, precipitation and refining of the metals contained as a mixed hydroxide concentrate. In connection with the renewed material synthesis of cathodic active material, it is to be investigated whether the separation of metal compounds is necessary in order to produce new, fully powerful cathode material. The research work on the preparation of the electrolyte and the graphite should show through the development of suitable processes that important electrolyte components and the graphite can also be efficiently prepared and used again in cell production in a quality suitable for batteries. All process steps are holistically accompanied by an ecological and economic life cycle analysis.

About the cooperation partners:

- As part of its battery strategy and its sustainability strategy, **Volkswagen AG** is very interested in the realization of a closed cycle of cell materials and has therefore taken on the coordination and management of the project. With the pilot plant for mechanical recycling at the components site in Salzgitter, the Group's Technology division ensures that recyclable material from vehicle batteries is produced and made available. In addition, the cell manufacturing expertise of the Center of Excellence in Salzgitter is used to produce new cells from completely recycled material.
- **TANIOBIS GmbH** is a leading global producer of high-quality tantalum and niobium-based materials for hydrometallurgical manufacturing processes including solvent extraction. As a subsidiary of JX Nippon Mining & Metals, the company has in-depth knowledge of hydrometallurgical recycling of lithium-ion batteries that are to be applied in the project.
- **J. Schmalz GmbH** is the world's leading supplier of vacuum technology and one of the few full-range suppliers in this field. In the Vacuum Automation business segment, Schmalz supplies all vacuum components for setting up grippers for industrial robots.
- **Viscom AG** develops X-ray measurement solutions specifically for use in the battery cell industry.
- **The Battery LabFactory (BLB)** as an established transdisciplinary research center of the TU Braunschweig is one of the leading institutions in the field of battery research in Germany.
- The **Institute for Machine Tools and Manufacturing Technology (IWF)** focuses on technological and automation issues along current and future manufacturing process chains of battery cells.

- The **elenia Institute for High Voltage Technology and Energy Systems** has extensive experience in the field of formation, cyclic aging and electrical and electrochemical characterization of battery cells.
- At the **Institute for Particle Technology (iPAT)**, mechanical and particle technology processes for the production of battery materials and electrodes as well as mechanical and thermal processes for battery recycling are investigated.
- The **Institute of Chemical and Thermal Process Engineering (ICTV)** has broad expertise in the separation of fluid mixtures.
- The **Institute for Energy and Systems Process Engineering (InES)** has many years of experience in battery modeling and simulation as well as electrochemical analysis and operando analytics.
- The **Fraunhofer Institute for Surface Engineering and Thin Films (IST)** researches material synthesis and functionalization and develops surfaces and layers for sustainable products.
- For **RWTH Aachen University, Institute for Metallurgical Process Technology and Metal Recycling (IME)**, the testing of new processes based on application-oriented fundamental work and the experimental scaling to the technical scale is a central goal.

*1: Details of TANIOBIS GmbH (as of June 8, 2022)

Company Name	TANIOBIS GmbH
Location	Im Schleeke 78-91, 38642, Goslar, Germany
Paid-in-Capital	EUR 26,000
Business operations	Development, production, recycling, and distribution of high-quality metals and metal compounds, mainly Tantalum and Niobium-based products
Managing Directors	Kazuhiko Iida, Kazuyuki Marukawa, Takayuki Hitotsuyanagi, Hironori Wada, Yasushi Ogura

*2: Details of JX Metals Circular Solutions Europe GmbH (as of June 8, 2022)

Company Name	JX Metals Circular Solutions Europe GmbH
Location	Neue Mainzer Str. 20, 60311 Frankfurt am Main, Germany
Paid-in-Capital	EUR 25,000
Business operations	Comprehensive promotion of the battery-related business including LiB recycling
Managing Directors	Kazuyuki Marukawa, Takayuki Hitotsuyanagi, Thomas Zipfel, Toshiaki Sato