

② Electrifying Vessels with Next-Generation Batteries

3DOM also planning to build model ships

3DOM Inc. (President: Masataka Matsumura) is a next-generation battery venture originated at Tokyo Metropolitan University. The goal is to develop technology for the 100% electrification of mobility. 3DOM is working to use proprietary separator technology to improve the performance of lithium-ion secondary batteries and develop next-generation batteries. The company is also expediting plans to build model ships to promote the electrification of small vessels. Executive Vice President Hiromichi Aoki explains, “First we will proceed with the full electrification of small vessels. In long-range coasting and ocean-going vessels, we aim to implement CO₂-free fuel cells as soon as possible.”

■ Strength in Separator Technology

— How did the company start?

“3DOM was established in 2014 and originally centered on the development of separators, a key component of lithium-ion batteries. Tokyo Metropolitan University is a joint research institution. 3DOM's battery-related technology was the first selected for Phase D (large-scale demonstration research and development), a designation by the New Energy and Industrial Technology Development Organization (NEDO) to support the practical application of promising technologies.”

— What is the status of next-generation battery development?

“3DOM is currently developing three types of next-generation batteries: a 2nd generation lithium-ion battery with improved reliability by mixing flame-resistant material into the cathode, a 3rd generation lithium metal battery with significantly increased energy density using lithium metal as the anode, and a 4th generation solid-state battery with significantly improved longevity and reliability using solid electrolyte. We are in discussions with manufacturing facilities with the aim of bringing next-generation batteries using 3DOM technology to market within the year. We have also completed development of ‘Proteus,’ a new energy storage system (ESS) for marine and other applications, through U.S. subsidiary LAVLE.

“Our subsidiary Kaula is encouraging recycled use of batteries with clear usage histories and proven viability by predicting and recording how customers use batteries and the resulting degree of battery degradation using blockchain technology. We foresee a large demand for secondary use of vessel and EV batteries as a backup power source in times of disaster or off-

grid power source in areas without a power grid.”

— In what technology does 3DOM’s strength lie?

“Separator technology. It features uniform pores, high energy density, and excellent heat resistance. It can also suppress the formation of dendrite (dendritic metal crystal), which occurs when batteries are repeatedly charged and discharged and causes ignition. Separators had been thought unnecessary in solid-state batteries as the solid electrolyte itself would act as a separator. However, in recent years it has become popular opinion that dendrite formation cannot be avoided, and separators are necessary. That being the case, 3DOM’s strength in this field gives us a competitive advantage.”

■ Starting with Electrification of Small Vessels

— What about vessel applications?

“Thinking about range and space on board, it is difficult to use batteries as a power source for coasting and ocean-going vessels. However, there is big potential in small vessels such as pleasure boats and water transport boats. Our marine business strategy until 2025 is to expedite efforts to first electrify small vessels. We will soon proceed with marine deployment of lithium-ion batteries and the construction of model ships, and also seek to form an experimental site for platform creation. When fuel cells proliferate in the future, we will be able to approach coastal and ocean-going vessels. At that time, we hope to pursue horizontal expansion of the platform functions developed in the small vessel market.

“To promote the electrification of small vessels, it is necessary to dispel shipowners’ concerns about increased costs and anxiety about the handling of batteries. On the other hand, the small vessel market is booming, with regular operations of electric water transport boats starting in Thailand and an electric outboard motor startup in China raising close to 1.7 billion yen. We believe that this wave will sweep through Japan, as well.

“Determining battery capacity for vessel use is not a simple task, as the power required varies by route, usage, and operating schedule. It is also necessary to identify the scale of initial costs and required battery capacity for actual installation on vessels. We are therefore currently gathering operational profiles, including maximum speed and operating area data, for ferries and water transport boats.”

— What efforts are you making to promote electrification?

“In order to promote electric small vessels, we want to develop model ships ourselves, rather than simply sell equipment like batteries. We aim to lead in the field by using these models to go about making proposals to shipyards and installing 3DOM batteries. We will consult with domestic shipyards as we begin to talk with marine manufacturers knowledgeable about

power-related equipment such as generators, motors, and switchboards.”

■ On to Biomethanol Fuel Cells

— Are you working on anything else new?

“In collaboration with the company’s CTO, Tokyo Metropolitan University Professor Kiyoshi Kanamura, 3DOM is developing a fuel cell that operates at a mid-range temperature of about 200 degrees Celsius. 3DOM separator technology is used in the electrolyte membrane. Easily-handled methanol is reformed to extract hydrogen and generate power, which is highly efficient and can greatly reduce the amount of platinum used as a catalyst. From an LCA (Life Cycle Assessment) perspective, we are planning to use biomethanol synthesized from biomass as a hydrogen carrier. Edible parts of rice or corn are used for food and feed, while residue such as leaves and stalks are used to produce biomethanol at a demonstration plant in Nagasaki. Through cascading use of residue we can avoid conflict between food and energy and aim to solve food, environmental, and energy problems. We want to green salt-affected and desert areas where CO₂ cannot be absorbed, produce biomethanol, and use it as energy for mobility. We are looking to create industry and employment in developing nations and bring carbon credits based on the CO₂ absorbed there to Japan.”

【3DOM Inc.】

▼Established: February 2014

▼Capital: ¥ 8,110,000,000 (including capital reserve)

▼Head Office: Yokohama, Kanagawa, Japan

▼Employees: Approximately 180