

No Resource Is a Waste — The Journey to Put CO₂ to Good Use



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The IHI Group is conducting research and development on synthesis technology for sustainable aviation fuel (SAF), which can significantly reduce carbon dioxide (CO₂) emissions compared to conventional fossil fuels. Among the variety of methods for producing SAF, the IHI Group is working to produce SAF by directly capturing CO₂ from the atmosphere and then directly chemically reacting the CO₂ with hydrogen (H₂). This method is highly cost-competitive due to the simplicity of the production process, where the intermediate process is not required. The demand for SAF is expected to increase in the future, and the synthesis technology will be one of IHI's key technologies. This issue features an interview with the developers of SAF, General Manager Yatomi and Senior Researcher Sato. Sato is stationed in Singapore and is working on research and development of SAF at a local research institute.

Establishing a circulatory system to produce jet fuel using CO₂

— How did you come to start developing SAF technology? —

Yatomi: This is based on my personal theory as an engineer: “Nothing in this world is wasted. Everything should be good for something. And where we are now is a point in a continuous flow from the past, and we are not at the end of it, but we need to connect it into the future. What should we do as engineers so that the next, and the next and the next generations and the generation after that can live with a smile on their faces and in abundance?”

In order to prevent global warming, CO₂ is often treated as a kind of waste, and when I found out that one way to reduce

CO₂ emissions is to bury them and fix them underground, I felt that it was as if people were trying to bury a “bad thing,” which is a waste of a resource. We began our work to develop SAF technology by asking ourselves, “How can we convert CO₂ into something good?”

IHI manufactures jet engines for aircraft. Burning jet fuel leads to the production of a large amount of CO₂. We believe that if we can somehow convert CO₂ into jet fuel, we can change it from a “bad thing” into a “good thing.” I'd like to create a system in which CO₂ is recycled in the same way as the natural world.

The development of SAF technology will be one of the key initiatives for the future of IHI, which has been continuously taking on the challenge of creating something new and unique in this world.

Accelerating the journey to practically apply SAF technology by combining catalyst development and engineering capabilities

— How are you developing SAF technology? —

Yatomi : First, with the aim of converting CO₂ into something valuable, we have been developing catalyst technologies using the methanation and lower olefin production technologies before working on SAF synthesis technology. To develop the catalyst technology, we are working with the Institute of Sustainability for Chemicals, Energy and Environment (ISCE²), a research institute under the umbrella of the Agency for Science, Technology and Research of Singapore (A*STAR). ISCE² has world-class catalyst development capabilities. The IHI researchers and ISCE² researchers are working closely to develop the catalyst through frequent discussions. IHI also has engineering capabilities with a track record of having manufactured many chemical plants, and we have been able to work with them on the practical application process from the early stages of development. We believe that by combining the strengths of our two organizations, we will be able to accelerate the journey to achieve practical application of the technology.

Social issues such as the prevention of global warming cannot be solved by the IHI Group alone. We believe that future technological development requires cooperation with companies and research institutes with technological strengths.

Utilizing machine learning to efficiently find the compositions of catalyst

— What are some of your creative approaches in the development of SAF technology? —

Sato : Synthesizing our desired chemicals in high yields is our core challenge. Catalysts are composed of combination of various metals, and we need to search for the optimal catalyst composition. By utilizing machine learning for this purpose, we can obtain results faster and more efficiently



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than a person could find them based on rules of thumb.

— What are your future development plans for SAF technology? —

Yatomi : Through our collaborative development with ISCE² that began in 2022, we have successfully developed the SAF synthesis catalyst with world-class performance for direct reaction of H₂ with CO₂. We plan to open a small-scale pilot plant in 2024 to prepare for practical application. We will open the plant to companies and research institutes that are considering using SAF to obtain their opinions, and further development will take place through repeated discussions with ISCE² researchers. In addition, we would like to make steady progress towards practical application of the technology by 2030, while establishing cooperative relationships with companies and research institutes that can become potential partners as well as obtaining new insights.

Our SAF video is now available!



IHI is developing the technology to produce sustainable aviation fuel (SAF) by directly reacting carbon dioxide (CO₂) with hydrogen (H₂).

In the “Building a New Tomorrow with Technology” series, we introduce the technologies that the IHI Group is working on to solve social issues and our strong passion.

Please scan the QR code
to watch the SAF video.

