Ammonia as a fuel to significantly contribute to climate protection

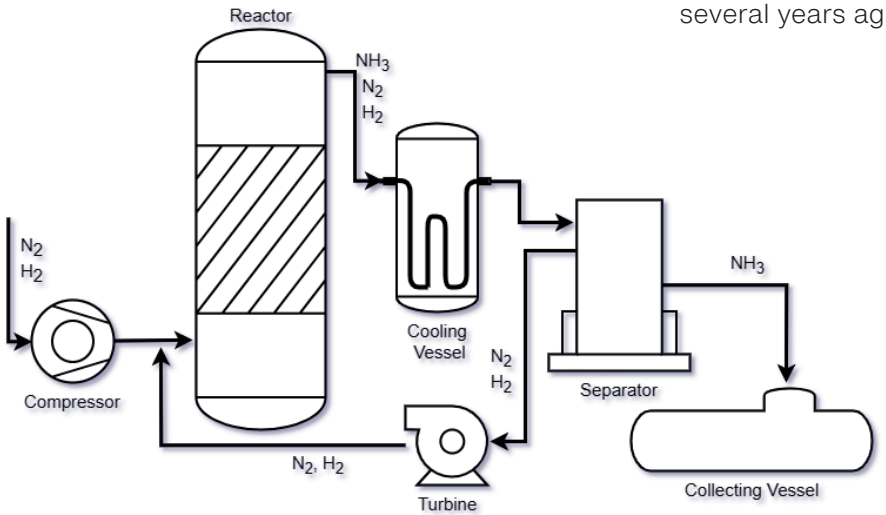
Due to climate change, the calls for alternative forms of energy are becoming louder and louder. Carbon-free energies, such as hydrogen, are particularly important in this context. But transportation and storage of this element are difficult due to the required temperature and pressure conditions. Whereas, ammonia shows the potential to establish itself as an alternative to hydrogen. Compared to hydrogen, transport and storage of ammonia are much easier. Even the energy density is much higher. However, ammonia is also considered to be an air pollutant that forms particulate matter together with other substances. Therefore, precise monitoring of various uses and forms of this alternative energy is important.

Transport and storage of ammonia can be realized much more easier compared to hydrogen

Ammonia has been widely applied across industries for many years. In agriculture, it is a well-proven component for fertilizer in particular. Therefore, the infrastructure for the production, storage, and transport of ammonia has been in place for a long time. The best-known and most widely used technique for the generation of ammonia is the Haber-Bosch process. In this technique, hydrogen reacts with nitrogen from the air in a reactor to form ammonia. In conventional ammonia production, the energy often comes from natural gas, resulting in up to 1.5 tons of CO_2 per ton of ammonia.

However, in the context of climate change, the focus is shifting increasingly to 'green ammonia', in which the hydrogen used for ammonia production comes from renewable sources.

In addition to being converted back into hydrogen as an energy carrier, ammonia can also be used directly because of its combustibility. Due to its components, ammonia burns without the release of carbon dioxide and is therefore considered climate-friendly. Research is already underway to develop engines using ammonia as a direct fuel. A milestone in this new approach was achieved several years ago by researchers in South Korea.



Schematic illustration of the Haber-Bosch process for the production of ammonia

Ammonia fueled car – a pilot project from South Korea

Back in 2012, researchers at the Korean Institute for Energy Research (KIER) developed a car powered by a mixture of 70% ammonia and 30% gasoline. Because ammonia does not contain any carbon, no CO_2 is produced in the engine compartment during combustion. Therefore, compared to a purely gasoline-powered vehicle, there is a considerable reduction in harmful greenhouse gases.

A key advantage of this ammonia-fueled system is that it can also be installed in existing vehicles. This could significantly accelerate the switch to carbon-free or low-carbon fuels alternatives. Completely replacing vehicles with new low-emission models alone would take much longer in comparison. A retrofit of 20% of all vehicles in South Korea could save around 15% of the country's greenhouse gas emissions from the transport sector, according to the Ministry of Science, ICT, and Future Planning (reported by Korean news agency, Yonhap).

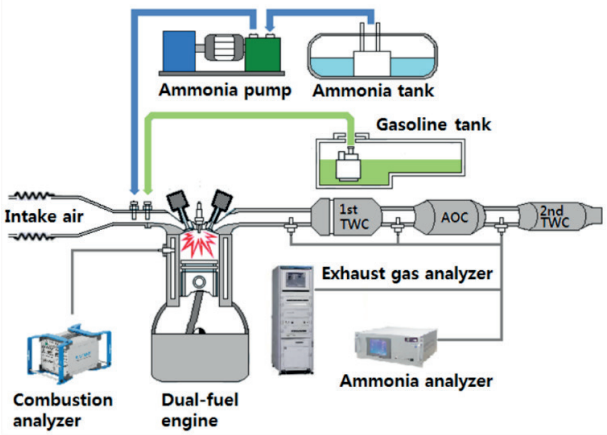
A small car powered by ammonia and gasoline – the result of KIER's AmVeh project

After further optimization of the fuel system and the exhaust treatment, the AmVeh project team is now working on a system that runs solely on ammonia. This would keep the engine completely free of carbons. Water and nitrogen would be the only end products of this combustion.

The importance of exhaust gas measurement in the AmVeh project

The combustion process must be precisely controlled, maintained, and measured. Otherwise, unburned ammonia could enter the exhaust gas stream. Ammonia is considered a major driver of particulate matter and so represents a burden on air quality, especially in densely populated cities. Therefore, the measurement technology also plays a significant role during the AmVeh project. In addition to general monitoring of the exhaust gas and composition, the measurement of ammonia is particularly crucial. The Airwell+7 gas analysis system from Kinsco Technology in South Korea, which works with Axetris laser gas detection modules (LGD), was used for this purpose.

The Airwell+7 gas analyser from Kinsco Technology



Schematic diagram of the ammonia-fueled system of the AmVeh project including exhaust gas measurement

By measuring with tunable diode laser absorption spectroscopy (TDLAS), even the smallest traces of NH_3 in the sub-ppm can be measured. In addition, this technique allows real-time measurement without warm-up times. Therefore, these measurements directly represent the quality of the combustion process.

J.D. Lee, the owner of Kinsco Technology, discussed the Airwell+7 and its application specifically for the AmVeh project.

J.D., how did the project with the KIER researchers for the ammonia-fueled system get started?

We first met in 2012 at a conference in South Korea. There we exchanged ideas about the project and they showed initial interest in the TDLAS technology of the Airwell+7.

Were other NH_3 measuring devices also tested against the Airwell+7 within the project?

Other techniques were also used for exhaust measurement. However, there was no other alternative for the measurement of NH_3. Other techniques showed a too high noise level during the measurement or could not handle the partly high NH_3 concentrations.

How satisfied were the KIER researchers with the NH_3 measurement performance of the Airwell+7?

The project staff was particularly impressed by the very good dynamic range of the TDLAS technology. From a few ppm up to the percentage range, the LGD could always convince with its performance.

How does the cooperation with KIER continue after the successful development of the ammonia-fueled system?

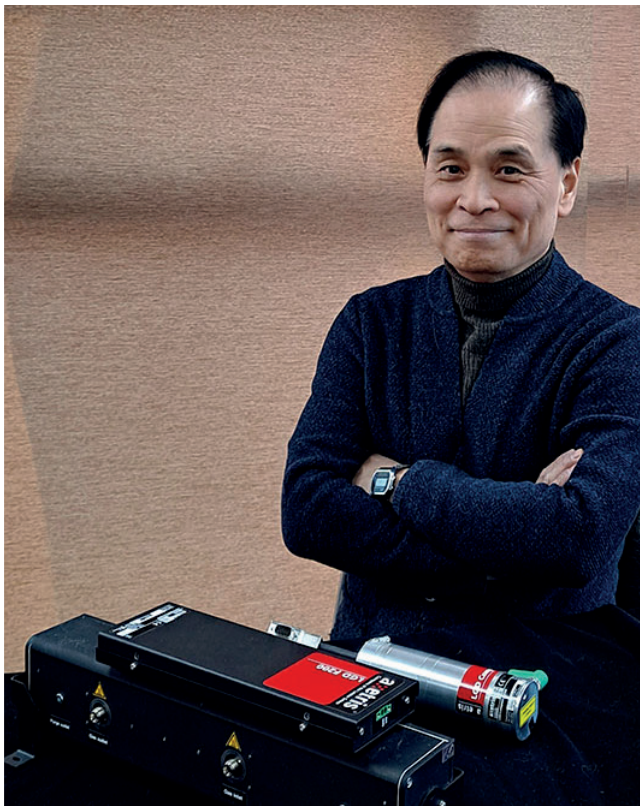
We are expanding our cooperation within the framework of further projects. The focus is currently on topics such as H_2 and green energy.

J.D., why did you decide to join the Axetris partnership program and what benefits do you see for yourself?

As a manufacturer of gas analyzers, customer service is one of the most important tasks in maintaining the good reputation of our company and the quality of our products. I'm convinced that the partnership program can provide targeted support for exactly that. In addition, for me, it is the basis of good communication and business relationship with Axetris.

"The advantages of TDLAS technology in gas measurement, such as no cross talk to other gases and the stable measurement, are sufficiently well known on the market. In addition, however, the LGD from Axetris can provide other positive aspects for use in the field, such as the very short warm-up times. Even when measuring hot gases, the devices are ready for use in a very short time, enabling my customers to work more efficiently. In addition, the implemented drift compensation enables stable measurement without constant maintenance intervals."

J.D. Lee, Kinsco Technology, Seoul



J.D. Lee, owner of Kinsco Technology;
For more visit www.kinsco.co.kr.

Axetris partnership program for LGD system integrators

In early 2021, Axetris launched a new partnership program to support and promote system integrators. In mutual agreement, primarily long-standing partner companies will take part in this program. This will secure a closer collaboration for Axetris LGD technology in their geographic sales market, among other things.

In addition, qualified companies are trained as recognized service centers and can offer their customers, as well as other Axetris customers, more extensive repair services, ensuring quick response in the field. Last but not least, the partners will also be directly supported with their products through Axetris' marketing activities. With this program, Axetris wants to build up long-term partnerships in industrial gas measurement technology, as well as to help the TDLAS technology to become more known in further applications.

Based on Axetris Laser Gas Detection Technology
Built in
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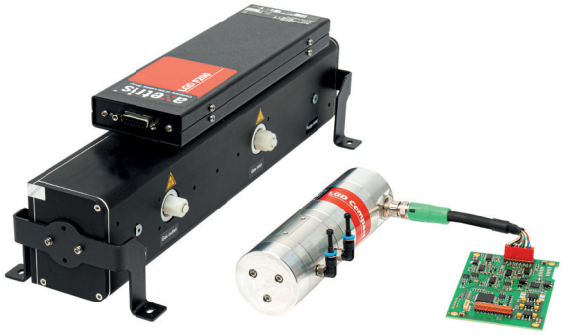

About Axetris OEM Gas Sensing Solutions

Laser Gas Detection (LGD), based on Tunable Diode Laser Spectroscopy (TDLS), provides a solution to many gas analysis challenges in emission monitoring and process control. The technology offers unique advantages like precise optical, contactless measurements, excellent target gas selectivity and sub ppm-level detectivity.

Axetris supports their OEM customers with in-depth technology and application expertise from feasibilities until product launch. The Axetris team collaborates with their customers in finding the right product design which best suits their needs in terms performance and costs. As an OEM partner, Axetris assists with setting-up the infrastructure and with technical training.

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