GRT, EPFL Create World's First Formic Acid-Hydrogen Fuel Cell Device

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About Aruna Urs Aruna is an industrial journalist. He writes on innovations that emanate at the intersection of science and engineering having a profound impact on the manufacturing sector. Follow me

GRT Group and EPFL scientists have built the world's first integrated power supply unit that produces electricity from formic acid-based fuel cells.

HYFORM-PEMFC project being carried out by the GRT Group, and Professor Gabor Laurenczy's research group at EPFL – who have developed a new, integrated formic acid-hydrogen fuel cell device.

Compared to devices that only use hydrogen, the HYFORM-PEMFC has been designed to ensure substantial benefits in terms of size – 1 liter of formic acid carries 590 liters of hydrogen, ease of transportation, safety, and lower operating costs while being completely environmentally sustainable.

According to the researchers, HYFORM-PEMFC can be used in areas with limited or no access to the power grid, and by those who develop hydrogen transport systems.

The unit can supply an alpine chalet with heat and electricity easily and with environmentally friendly refueling. The technology can be also be scaled up to meet the power needs of larger settings, such as industrial plants.

When it comes to renewable energy storage solutions, hydrogen is one of the most promising energy carriers. Using hydrogen to produce heat or electricity produces no carbon or particle emissions, meaning that it has no negative environmental impact.

The problem is that hydrogen has a very low energy content by volume. This makes it very difficult to store and transport in its natural form (gas), or requiring very high pressures, very low temperatures, and expensive infrastructures, all of which translates into safety and cost concerns.

The alternative according to the researchers is to use a hydrogen carrier such as formic acid, which is the simplest combination of hydrogen and CO2.

Formic acid is liquid at normal conditions, easy to store, transport, and handle, and is produced from sustainable sources in hundreds of thousands of tons globally: it is already used widely in agriculture, and the leather, rubber, chemical, and pharmaceutical industries.

The challenge lies in getting the stored hydrogen back out of the formic acid in an energy-efficient manner. This is where catalysts come in.

The device consists of two main parts, a hydrogen reformer (HYFORM) and a proton-exchange membrane fuel cell (PEMFC). The HYFORM reformer uses a ruthenium-based catalyst to extract hydrogen, although the scientists are currently developing catalysts

based on even cheaper materials.

The unit can produce 7000 kWh yearly, and its nominal power is 800 Watts – roughly the equivalent of 200 smartphones being recharged simultaneously. Its electrical efficiency is currently up to 45%.

Content and image: GRT Group/EPFL

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