Achievements and future prospects for the use of hydrogen fuel in automobiles

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Abstract: This article provides information on the prospects for the use of hydrogen gas as fuel in cars, what parameters hydrogen fuel cars (HFCV - Hydrogen Fuel Cell Vehicles) differ from conventional internal combustion engines, processes and methods of using hydrogen fuel in cars. Scientific achievements in this regard will be analyzed.

Keywords. Hydrogen fuel cars (HFCV - Hydrogen Fuel Cell Vehicles), electricity, engine, fuel, exhaust gases, protons and electrons, water vapor and hydrogen molecules

Hydrogen fuel cars (HFCV - Hydrogen Fuel Cell Vehicles) convert hydrogen fuel into electricity, unlike conventional internal combustion engines. This technology is aimed at providing cars with clean energy and works without carbon emissions, only water vapor is generated. In these vehicles, fuel cells generate electricity, directly powering the car's electric motor. Hydrogen fuel cars have fuel cells that generate electricity through a chemical reaction between hydrogen and oxygen. During this process, hydrogen molecules are broken down into protons and electrons. Protons move directly through cells, while electrons create an electric current. This electric current powers the car's electric motor.Hydrogen fuel cars have fuel cells that generate electricity through a chemical reaction between hydrogen and oxygen. During this process, hydrogen .

While this technology is much cleaner and more efficient, one of its main difficulties is associated with the safe storage and transport of hydrogen. The high flammability of hydrogen, as well as the limited infrastructure, makes it difficult for this technology to spread widely. In order for hydrogen to be used as a car fuel as seen above, this energy is used as the energy that drives the car, after initially converting it into electricity in the car itself. In this process, we can see that the law of conservation of energy works. And in the next way, a hydrogen unit and a storage tank are installed on board the car, and this technological solution is now a problem of engineering. Because hydrogen gas is aged 14.5 times lighter than oxygen and is considered to be at high risk of exploding when stored in a special tank.

Why is hydrogen fuel seen as an alternative to carbon-based conventional fuels in cars?

Environmental impact and reliability: hydrogen fuel cell (fuel cell) cars use 29-66% less energy for propulsion compared to conventional fuel-based cars and thus produce 31-80% less greenhouse gas emissions. This shows cars as an important tool in reducing pollution in the future. [1]

Market prospects: globally, the hydrogen fuel-based automotive market is expected to show significant growth by 2028, as evidenced by the wide future use of this technology. [2]

In recent years, several large car companies have placed a strong emphasis on the production and development of hydrogen-fueled cars. Below we list the most advanced companies:

1. Toyota. Toyota is one of the leading companies in the hydrogen fuel machine market. Their Toyota Mirai model is the first commercial car of this technology to be presented to the general public. The Toyota Mirai has a range of 402 miles (about 647 km), and its Fast Fuel Injection time is no different from typical gasoline-powered cars.

2. Hyundai. Hyundai has also invested heavily in hydrogen technology. The Hyundai Nexo hydrogen fuel car they produced could cover 380 miles (about 611 km), and this model had the highest

safety rating in 2022. The Hyundai Nexo hydrogen fuel car they produced could cover 380 miles (about 611 km), and this model had the highest safety rating in 2022.

3. Honda. Honda is taking new steps to develop its hydrogen fuel cars. The Honda CR-V model, expected to be released in 2025, will be a plug-in (rechargeable) electric and hydrogen car. This new model is capable of covering 270 miles (about 435 km).

4. BMW. BMW recently introduced its own iX5 hydrogen SUV, but this is now only a concept car. He is likely to enter the commercial market in the future.

5. Mercedes-Benz. Mercedes-Benz has also been researching the development of hydrogen fuel cars. Their Mercedes-Benz GLC F-CELL model is a plug-in hybrid that combines two technologies: an electric battery and hydrogen fuel.MW recently introduced its own iX5 hydrogen SUV, is is now only a concept car. He is likely to enter the commercial market in the future.

6. Nikola Motors. Nicola Motors is focusing on trucks and commercial vehicles. Their hydrogen fuel trucks are an efficient and clean solution for the transportation of heavy loads and are aimed at solving environmental problems.

Future of hydrogen vehicles: While hydrogen fuel vehicles will have a large potential in the future, the cost of infrastructure and technology is currently one of the main limitations. But developed countries and automakers continue to be interested in hydrogen technology, which in the near future may lead to a wider distribution of these vehicles. Thus, hydrogen fuel machines are an effective and future-oriented solution aimed at protecting the environment. With the technical development of technology and the improvement of infrastructure, these machines can become more widely popular, ushering in a new era in the automotive industry.

References

1. Performance, emission and economic analyses of the hydrogen cell vehicles feel fu (renewable and sustainable energy Reviews, 199 (2024) 114543) Pobitra Halder a,* , Meisam Baba b , Farhad overdose we have c , Kalpit Shah d , Svetlana Stevanovic a , Timothy A https://doi.org/10.1016/j.rser.2024.114543

2. The future of hydrogen. OneH2 journal.11.01.2023. In ie (2019), the future of Hydrogen, EA, Paris https://www.iea.org/reports/the-future-of-hydrogen, Licence: CC BY 4.0

3. Feel Fu Hydrogen News. https://www.hydrogenfuelnews.com/featured-news/

4. Hydrogen production is the production for hydrogen elektrolezyori qitrilmasi. J. F. Ismatov, R. A. Qurbanov, Asqarov. INTERNATIONAL SCIENTIFIC AND PRACTICAL CONFERENCE ON THE TOPIC “INTEGRATION OF SCIENCE, EDUCATION AND TECHNOLOGY, DEVELOPMENT TRENDS, PROBLEMS AND SOLUTIONS AS USED IN THE TRANSPORT OF” FACULTY “TRANSPORT ENGINEERING” DEPARTMENT “TRANSPORTATION ENGINEERING” MEANS MARCH 28 - 29, FROM 2025. JIZZAKH POLYTECHNICAL INSTITUTE, MARCH 28-29, FROM 2025