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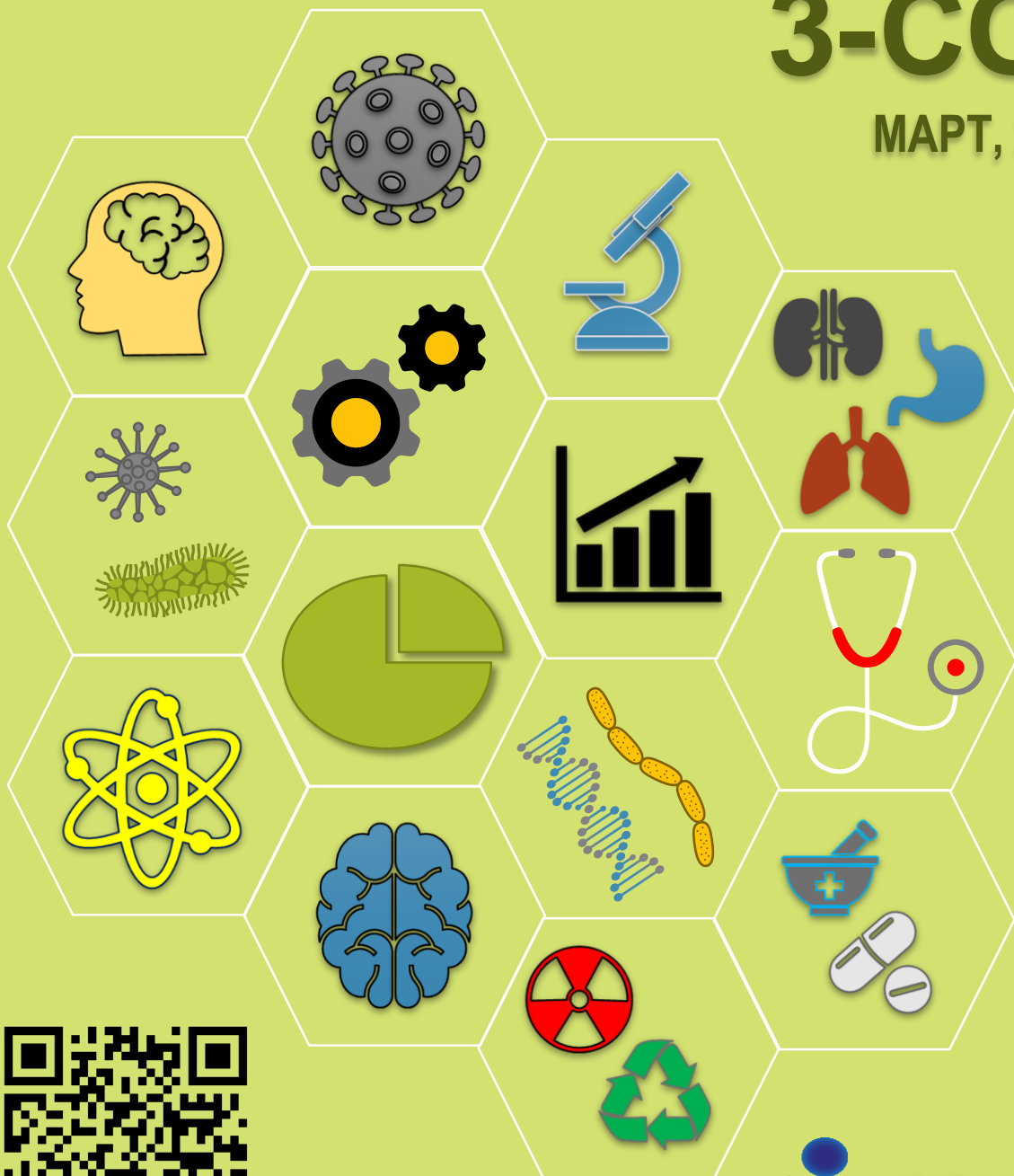
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ЭКСПЕРИМЕНТАЛ ТАДҚИҚОТЛАР ЖУРНАЛИ

ЖУРНАЛ ЭКСПЕРИМЕНТАЛЬНЫХ ИССЛЕДОВАНИЙ | JOURNAL OF EXPERIMENTAL STUDIES

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PRACTICAL ASPECTS OF SUPERCONDUCTIVITY IN SOLVING PROBLEMS OF HYDROGEN

ANNOTATION

This article provides information about the need to develop hydrogen energy based on current needs and the aspects of superconductivity. Based on the progress of superconductivity, directions for solving problems of hydrogen energy are considered.

Key words: Hydrogen energy, superconductivity, superconductor, hydropower reserves, inversion temperature, the non-return line of magnetic induction.

ANNOTACSIYA

Ushbu maqolada vodorod energiyasini o'ta o'tkazuvchanlik xususiyatlari asosida rivojlantirish haqida ma'lumot berilgan. O'ta o'tkazuvchanlikning rivojlanishiga asoslanib, vodorod energiyasi muammolarini hal qilish yo'nalishlari ko'rib chiqiladi.

Kalit so'zlar: Vodorod energiyasi, o'ta o'tkazuvchanlik, o'ta o'tkazgich, gidroenergetika zahiralari, inversiya harorati, magnit induksiyaning qaytmaydigan chizig'i.

АННОТАЦИЯ

В данной статье представлена информация о необходимости развития водородной энергетики исходя из текущих потребностей и аспектов сверхпроводимости. На основе развития сверхпроводимости рассмотрены направления решения проблем водородной энергетики.

Ключевые слова: Водородная энергетика, сверхпроводимость, сверхпроводник, запасы гидроэнергии, температура инверсии, обратная линия магнитной индукции.

We need to understand that the superconductivity combined with the hydrogen economy can be a solution to our decentralized energy problems. The world is facing a steady decline in fuel resources and climate change is accelerating. Energy demand is expected to grow by 56% in 2010-2040. It could increase fivefold by 2100 due to population growth and accelerated global industrialization [1, P.54].

Given the forecast of energy demand in transport and electricity supply, the demand for energy production, storage and use will increase and the need for innovation will increase. Currently, the energy supply is partially dependent on carbon. It is expected that in the future it will be a supplier of renewable energy electricity. Measures should be taken to reduce the impact of global energy problems on the study and development of sustainable energy supply. Combining energy storage systems with renewable energy, such as wind, can save wasted energy. Capital costs of storage systems are an obstacle to their widespread installation. However, with energy management, profits can be increased by supplying stored energy at times of high demand and prices.

As the use of renewable energy increases, so does the need for storage. Pumped hydropower reserves currently account for 99% of global energy storage capacity of 127,000 MW. Non-pumped hydropower reserves are distributed among other storage technologies shown in Figure 1 [2, P.102].

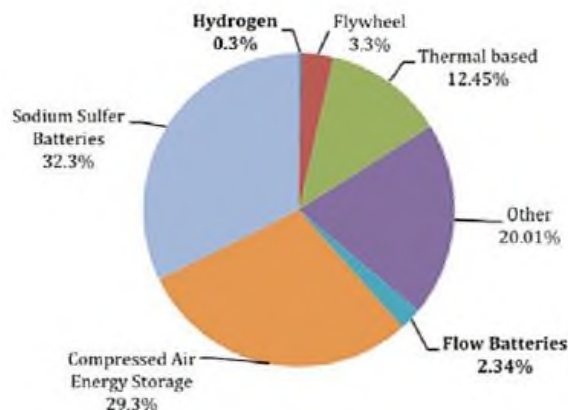


Figure 1. Share of resources in non-pumped hydropower reserves.

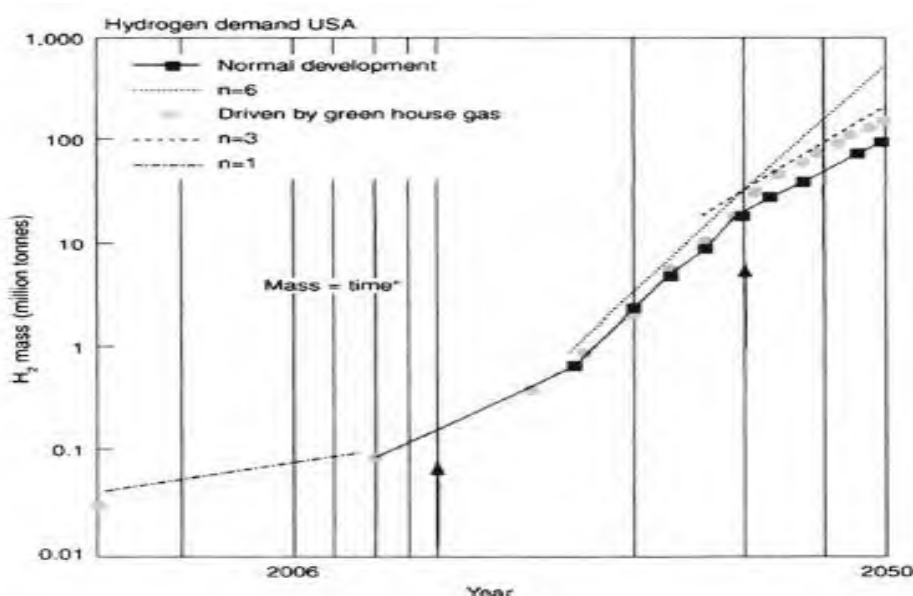


Figure 2. Predicted mass production required by the U.S. economy over time.

Methods. Global hydrogen production in 2010 was 53 million tons, and this demand is expected to grow by an average of 5.6 % in the coming years. The use of hydrogen plays an important role as a chemical raw material. It is expected that the factors driving the increase in hydrogen production will be regulations that require a reduction in sulfur content in petroleum products, the need to process declining crude oil and the search for cleaner fuel options. At present, it accounts for only 12% of hydrogen production, but this share is expected to increase to 50% by 2050 [3, P.87].

It is clear that the differences between the two scenarios, that is, informal development and demand based on greenhouse gases, are almost the same until 2050.

The calculated $mass = time^n$ value can increase 2 to 6 times in the next 10 years (figure 2).

Hydrogen is an energy carrier with a low energy density at standard atmospheric pressure and temperature. Therefore, it should normally be stored at 35 or 70 MPa as compressed hydrogen or in cryogenic containers as liquid hydrogen. A hydrogen storage system requires the use of other raw materials to produce hydrogen as a storage medium. The most common electrolyzes are hydroxide electrolyzes, with an efficiency of 52 to 83%. Polymer electrolyte membrane electrolyzes are being developed and are expected to increase their operational efficiency and reduce the overall cost of the electrolyte. Various efficiencies have been shown for hydrogen compression, from low efficiency of 52% to high efficiency of 85%. There are different types of fuel cells [4, P.85].

Proton exchange membrane fuels are the most modern for transport and office operation and have an efficiency of 53.5%. Another fuel cell under study is the solid oxide fuel cell, which is thought to be highly efficient due to its high operating temperature, where some of the heat can be used to supply heat for domestic needs. They can be used to generate renewable heat and electricity together. The compressed hydrogen reservoir is suitable for storing wind energy due to its high energy density of 1246 kW m³. This makes it suitable for storing large amounts of energy. Based on the extensive experience of superconductors, it is correct to say that hydrogen can be stored as a liquid at a temperature of 14 to 33 K. Liquid hydrogen is a cryogenic coolant for almost all superconductors. The value of hydrogen liquefaction depends on the amount of hydrogen produced. The higher the amount of hydrogen, the less energy is used and the more efficient and economical the process. A large amount of energy must be present during the liquefaction process. The liquefaction process can occur with the Joule-Thomson expansion cycle. Hydrogen is compressed at ambient pressure and passes through a heat exchanger, where the temperature decreases. As a result of the cooling of hydrogen as a result of expansion, the temperature must be lower than the inversion temperature $T_{inv}=200$ K. Nitrogen is pre-cooled before the hydrogen passes to the expansion valve. The energy required for compressor and expansion baths reduces the overall efficiency of the process. Liquid hydrogen is a cryogenic liquid, in low-temperature, insulated cryogenic vessels of Tpoil, which are designed with double walls and an insulating gap between the two walls to reduce the heat transfer of the liquid. Heat exchange causes the liquid to evaporate and gas to form, a process that boils. The heat also comes from the ortho-para variant of hydrogen [5, P.14].

Depending on the electronic configuration of hydrogen, it can exist as ortho- or para-hydrogen, but as a result of ortho-para conversion, boiling heat is released. At room temperature, hydrogen is 25% para- and 75% ortho-hydrogen, and at 20 K it is about 99% para-hydrogen. To keep the hydrogen longer, the ortho-para option should be replenished before dilution to minimize boiling. The use of catalysts facilitates ortho-para conversion of hydrogen. Another type of energy storage that uses hydrogen and is offered as a flexible option for storing backup electricity is a superconducting magnetic energy storage system that has the potential to benefit greatly from hydrogen cryomagnetic technology. The electricity consumed is the periodic energy of renewable production. Liquid hydrogen is very important for the system because it is used to supply electricity to the fuel cell and to cool the superconducting coil.

Oxygen in 20 K (under normal pressure), an oxygen tank is needed for the system to store it. It is recommended that the fuel cell be used to provide a constant supply of electricity and that the superconducting magnetic energy storage system respond to peak current changes or power outages. As the penetration of renewable technologies into the grid increases, there is a need to save a large amount of electricity. Recommended is a hybrid system using liquid hydrogen and a conductive coil; the spiral used is a magnesium boride spiral. This special model has a capacity of 12 GWh of energy in liquid hydrogen and 48 GJ of energy stored in the magnetic energy of superconductors. Hydrogen is used in the future energy scenario of the world to replenish electricity and act as a storage and cryogenic coolant.

Currently, the world's leading scientists are doing a lot of research to achieve the development of hydrogen energy using various physical processes. One of the innovative ideas for increasing the efficiency of hydrogen energy is to identify and study its aspects related to superconductivity [6, P.149].

Helium deficiency has been reported in the literature for the use of multiple conductors. On the other hand, the use of hydrogen as a cryogenic coolant is considered to be a useful and economically viable cooling option for superconducting devices. The new engineering designs, originally manufactured MgB₂ superconducting wires, include: a fully self-conducting ship, DC current limiters, superconductors for current homopolar motors, fusion, superconducting magnetic energy systems and magnetic resonance imaging (MRI) systems with MgB₂ magnets.

The development of MgB_2 superconducting HVDC cables for indirect cooling of liquid hydrogen is proposed as an early candidate, especially for computer data centers and entire electric vessels.

The use of hydrogen as a coolant and energy carrier leads to the development of new research and development on superconducting materials, and the efficient use of energy significantly increases the scale of superconductivity. As for the hydrogen-cooled superconducting materials used in the manufacture of practical conductors, the indistinguishable lines of the two main categories are shown in figure 3.

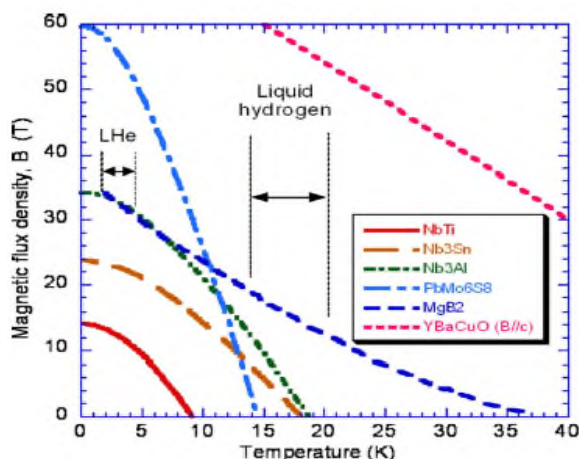


Figure 3.

The non-return line of magnetic induction B_q relative to temperature T , for low-critical superconductors, medium-critical temperature MgB_2 ($T_k = 39$ K) and high-critical superconductors $YBa_2Cu_3O_7$ ($T_k = 91$ K). Magnetic flux density B , parallel to the crystallographic direction c of the superconductor $YBa_2Cu_3O_7$ [7, P.49].

The development of efficient and cost-effective helium gas cryopumps is the most important task for the introduction of indirect liquid hydrogen technology in the market and the implementation of cooperation between superconducting applications and liquid hydrogen. At present, hydrogen cryogenic gas circulators (for example, cryopumps and cryofan designs) are not very well developed in the industry and therefore there is only one product b die, and there is a range of ryozone cryofan. This design provides a direct thermal connection to the engine assembly at ambient temperature through the propeller axis at cryogenic temperatures. This design requires a shaft seal that must be able to withstand cryogenic temperatures and high pressures, as gas cooling requires a pressurized gas to be effective. The research is aimed at developing the concept of a magnetically coupled engine propeller "CryoMagFan", which holds a complete, continuous vacuum envelope to reduce heat loss, prevent helium leakage and ensure high working pressure (figure 4).



Figure 4. a) A type of cryozone chyrophanes. b) Noordenwind CryoFan helium gas cooling system manufactured by Cryozone (1); superconducting spirals such as solenoids, bearings, etc.; its heat exchanger (3); closed-loop cryoler head or liquid hydrogen cryostat.

The reason superconductors are used in the storage and transportation of liquid hydrogen is because it is beneficial to the economy. The practice of transporting and delivering hydrogen in superconducting pipes has been introduced on the basis of cost-effectiveness.

LIST OF REFERENCES

1. Ahadov A.A. Existing problems and solutions in hydrogen energy and superconductivity. Dissertation for a Master degree. Bukhara, 2022.
2. Djuraev D.R., Ahadov A.A. Physical properties of magnesium diboride superconductor and its role in hybrid energy transfer. *European multidisciplinary journal of modern science*, 5, 222-229. 2022.
3. Djurayev D.R., Ahadov A.A. The interrelationship of hydrogen energy and superconductivity is a new area research. *Science and education*, volume 3, issue 4. 272-281. 2022.
4. Джураев Д.Р., Ахадов А. А. “Проблемы водородной энергетики и их решения”. “Zamonaviy mikroelektronikaning rivojlanishida fan,ta’lim va innovatsiya integratsiyasi” Respublika ilmiy-uslubiy anjumani, 247-249. Andijon, 2020.
5. D.R.Djurayev, Ahadov A.A. “Vodorod energetikasi va o‘ta o‘tkazuvchanlik”. “Tafakkur va talqin” mavzusida Respublika miqyosidagi ilmiy-amaliy anjumani. 35-39. Buxoro, 2021.
6. Djurayev D.R., Ahadov A.A. Existing problems and solutions in hydrogen energy and superconductivity. “Tafakkur va talqin” mavzusidagi Respublika miqyosidagi ilmiy-amaliy anjuman to‘plami (II qism), 456-460. Buxoro, 2022.
7. Djurayev D.R., Ahadov A. A. “Hydrogen energy: advantages and disadvantages, problems of using”. “Zamonaviy mikroelektronikaning rivojlanishida fan,ta’lim va innovatsiya integratsiyasi” Respublika ilmiy-uslubiy anjumani, 243-245. Andijon, 2020.

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