

Innovation products of NIC NEP

External power sources for portable electronic devices VIP-T and VIP-N.

External power sources VIP-T (for mobile phones) and VIP-N (for laptops) are designed for charging batteries of portable electronic devices at absence of a stationary electrical grid. The systems include an air-breathing PEMFC battery, a hydrogen-on-demand cartridge generator and a DC/DC converter. In case of VIP-N the converter is integrated with a control system for battery and electromagnetic valves. Hydrogen is evolved from water by its interaction with activated aluminum powder inside the cartridge-generator. The use of air-breathing FCs batteries is driven by the need to reduce the balance-of-plant system dimensions and to get a compact design for portable devices. The hydrogen cartridge for VIP-N includes several interchangeable hydrogen generators to provide an uninterrupted device operation during a generator replacement.

Concentrator solar batteries based on semiconductor heterostructure junctions.

This type of solar batteries is based on photoelectric phenomena in heterostructure junctions on different types of semiconductor materials (predominantly gallium arsenide). Structure and materials of junctions are designed to utilize the most part of solar radiation spectrum into electric energy. To increase the efficiency and to decrease the active elements surface area Fresnel concentrating lenses are used to concentrate sun radiation on the small active element area. One 50x50 cm² module produces about 50 W (electrical energy). The efficiency of a single solar cell is closed to 35%, the whole solar module – up to 24–28%.

Moderate and low-temperature membrane-electrode assemblies (MEAs).

MEA is the key component of PEMFC. NIC NEP have two kinds of MEAs under development jointly with FuMA-Tech – for moderate-temperature and low-temperature fuel cells. MEA for low-temperature fuel cells includes the perfluorinated Fumapem[®] membrane developed by FuMA-Tech and cathode catalyst developed by NIC NEP. The moderate-temperature MEAs include several types of PBI-membranes developed by NIC NEP and FuMA-Tech. Now the second PBI-based membranes generation is under development. Its synthesis doesn't involve toxic organic compounds. The main advantage of moderate-temperature fuel cells is their increased up to 160°C operating temperature which allows to use a hydrogen-rich gas obtained by hydrocarbons reforming as a fuel. The multicomponent cathode catalyst for low-temperature fuel cells allows to decrease twice the platinum content in the catalyst without significant losses in activity.

Backup power station NIC NEP-1 based on polymer electrolyte membrane fuel cells.

The backup power station NIC NEP-1 is designed for emergency power supply of individual customers and consumers in remote areas. This power system is distinguished for its high reliability and zero emission.

Technical characteristics:

1. Electric power:
 - at operation mode 1 kW
 - at full load conditions 1,3 kW
2. Electric current parameters:
 - current type direct
 - voltage 10 – 12 V
3. Operating temperature: Up to 80°C
4. Fuel:

Technical hydrogen according to State standard (GOST) 3022-80 of B grade:

 - consumption at operation mode 0,053 kg/hour
 - consumption at full load conditions 0,07 kg/hour
 - operating pressure 0,15 MPa
 - cylindrical storage system, pressure 30 MPa
 - operation time 6 hours
5. Released heat:
 - at operation mode 0,8 kW
 - at full load conditions 2,3 kW
6. Dimensions (m):
 - width, length, height 0,53 x 0,6 x 0,86

High-pressure electrolyzer

The high-pressure electrolysis module (up to 10 MPa) is designed to generate hydrogen and oxygen gases. This is an important component of an experimental hydrogen-oxygen energy storage system based on an electrolyzer and a fuel cell stack. Such a system can be used in technology processes' control systems, in production of semiconductors, metallurgy, autonomous power plants as a part of power supply buffer systems and other areas.

Technical characteristics:

- Hydrogen yield 0,12 Nm³/hour
- Oxygen yield 0,06 Nm³/hour
- Operating voltage, up to 25 V
- Energy consumption upon electrolysis up to 4,5 kWh/Nm³ H₂
- Operating pressure (H₂, O₂) up to 10 MPa
- Operating temperature 50-70 °C