I Hydrogen Production

Russian research and interest in international cooperation in novel hydrogen production technologies are focused at the next basic directions:

- Highly efficient new processes of H_2 and syn-gas production from hydrocarbon material (natural gas, methane, propane-butane mixture, alcohols, liquid fossil fuel) on the base of plasma catalysis.

- Plasmachemical technologies of large-scale hydrogen production from methane and hydrogen sulfide (acid gas) in non-equilibrium SHF – discharges

- Technology for natural gas thermal decomposition and waste wood processing yielding hydrogen and carbon (pyrocarbon of over 1.8 g/cm^3 density or other carbon material)

- New catalytic systems for hydrocarbon fuel processing and hydrogen production (including on-board and small scale devices)

- Advanced technologies for hydrogen purification and separation

- Advanced electrolysis (including SPE and HT)

- High temperature nuclear technologies for hydrogen production from fossil fuels and water

Research and development in these fields are carried out by many institutes of Russian Academy of Sciences, by Russian scientific centers (“Kurchatov Institute”, “Applied Chemistry” and other), by institutes and centers of Nuclear Energy Ministry (Minatom) of Russian Federation, Russian Aviation & Space Agency and Universities.

II Codes and Standards

Russia has experience in this area, particularly in liquid hydrogen technology and safety. Russian research centers and industry are very eager to participate in the internationalization of codes and standards.

Along with codes and standards of safety at hydrogen production, storage, transportation and utilization in fuel cells, common standards development is needed for hydrogen as a fuel for motor transport, for sensors, hydrogen afterburners, as well as International Tables of Physico-Chemical properties of hydrogen at temperatures 10-1500 K and pressures up to 200 MPa. These tables must be agreed with those accepted by IUPAC.

III Socio – Economic Issues

Russian scientists have experience with socio-economic studies of new technology impact. Such investigations were carried out for example by the Institute of People's Economy Prognostication of RAS, "Kurchatov Institute", Institute of High Temperatures, RAS and by others. In connection with hydrogen economy development, investigations of the role of hydrogen technology in the development of autonomous power supply systems for Northern and North-Eastern regions could be interesting. Besides, socio-economic studies of the possibilities for large-scale hydrogen production with the use of nuclear energy, including the technologies based on high temperature nuclear reactors are of great importance and interest. Certainly, the comparative analysis of the social cost of the fuel with respect to ecological damage on the whole cycle from production to ultimate consumer has undisputable importance.

IV Fuel Cells

Russian R&D in this field are focused at the next basic directions:

- Alcaline Hydrogen-Air Fuel Cells with removing of CO_2 from the incoming air
- PEMFC with membrane, produced by JSC “Plastpolymer” type MF-4SK and the modified ones
- Planar SOFC with YSZ – $(ZrO2)_{1-x}(Y2O)_x$ – type electrolyte and various type catalysts
- High-temperature membranes on the base of ZrO_2 and Y_2O with thickness 250-500 μm and 5-20 μm for different types of cells – electrolyte supported SOFC and Anode supported SOFC. Also other types of high temperature membranes are investigated.
- Non-precious metal catalyst for cathode and technologies for replacement of Pt with Pd
- New technologies for production of proton exchange membranes with high-exchange capacity and new methods of the membrane electrode assemblies production

V Hydrogen Storage

Russian specialists are involved in R&D and are interested in international cooperation in the following advanced technologies of hydrogen storage:

- Low-cost and high efficiency metal hydrides for hydrogen storage and purification

- Investigations of heat and mass transfer in dispersed metal-hydride media at sorption/desorption processes, including the case of the presence of admixtures in the incoming gas

- Advanced technologies of hydrogen liquefaction and LH_2 storage and transportation

- Technology of the production of cheap glass microspheres with further filling with hydrogen at pressure up to 100 – 200 MPa

- Methods of hydrogen storage in carbon nanostructures, fullerens and nanotubes.