RESEARCH AND DEVELOPMENT ON HYDROGEN PRODUCTION

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Hydrogen has not been produced and used as energy fuel, but the experience of its production and use draws information for the future possibilities of hydrogen as an energy vector, especially for use in fuel cells for of electric energy generation Brazil has a P&D program for fuel cell system that stresses the hydrogen production from renewed sources. IPEN has been developing three projects for hydrogen production: ethanol vapor, ammonia reforming and biomass gasifying. The anhydrous ammonia gas as raw material for the production of hydrogen is being studied due to be an abundant source, free of CO and CO_2, and to have a low cost. For the ammonia reforming the project included the design and construction of a laboratory scale reactor and the search for a convenient catalyst for the ammonia thermal decomposition. A stack was set up including the reactor, the furnace and temperature and gas flow measurement instruments as well, with a booster and inverter for the AC energy supply of 1.2 and 220 V. Manganese nitrite was used as catalyst for the ammonia reform. The thermal reform of ammonia using the above mentioned equipment has a yield greater than 99%. (FIG.1) shows the equipment installation used at IPEN for hydrogen production from ammonia gas. In a second hydrogen production line, ethanol is being used for the reform, as a renewed biomass source. For this process the catalyst is a ceramic material in form of microspheres with nickel, cobalt, chromium, manganese, zinc and molybdenum especially anchored.

FIGURE 1 - Hydrogen production from ammonia gas unit.

In (FIG.2) are shown some of catalysts prepared as microspheres by the sol-gel process for the ethanol reforming.

FIGURE 2 Microspheres catalysts from different metallic ions.

For the hydrogen production a mixture of ethanol and water is feed into an evaporator and then the gaseous mixture is sent to reform reactor where the reform is obtained with the help of the microspheres catalyst. The leaving stream contains H_2, CO, CO_2 and CH_4. Parameters as activity and catalyst selectivity, best molar ratio H_2O:EtOH, ideal temperature, flow feeding (alcohol + water) and life of the catalyst have been studied. Biomass has the potential to become one of the major global primary energy source for this century, and modern bioenergy systems are suggested as important to future sustainable development in industrialized as well developing countries. The study of biomass utilization for hydrogen production has been initiated at IPEN. The study is centered on wood-based products from primary and secondary residues of forest sector as felling residues, sawdust and pulping liquors. Different kinds of procedures can be used to generate energy from biomass but the method of gasifying it has been adopted in IPEN for hydrogen production. (FIG.3) shows different types of wood utilized in initial experiments.

FIGURE 3 - Wood for use in the gasification process.