1- INFLUENCE OF A PARTIAL INJECTION OF COMPRESSED AIR INTO DIESEL FUEL INJECTION SYSTEM

This work investigates the influence of a partial injection of compressed air into the diesel fuel injection system on the fuel spray characteristics. A small amount of compressed air has been injected into the high pressure feeding pipeline of the diesel fuel injection system. The study has been carried out with different cases of the injected air pressure, injection starting time and injection period into the high pressure feeding pipeline of the diesel fuel injection system. Affects on the fuel injection flow rate have been investigated. Also, an optical arrangement has been adopted to observe and measure each of atomisation mode, spray appearance, spray cone angle and DROP size distribution of the injected fuel spray. The results show a significant improvement in the atomisation mode and performance of the injected fuel spray compared with that in the case without a partial injection of compressed air.

2- EXPERIMENTAL STUDY ON H2/AIR PEM FUEL CELL

An Experimental study has been carried out to perform measurements on the performance parameters of H2/air proton-exchange-membrane, (PEM) fuel cell system. Tests are carried out to investigate the effect of hydrogen flow rate, cathode air flow rate, its temperature and relative humidity on the performance of the fuel cell. A 25 cm² single cell with serpentine anode and straight cathode flow channels is used as a test unit. Performance of the fuel cell is characterized through analysis of the polarization curves and the power density vs. current density curves as well as the hydrogen utilization and the electric cell efficiency. Obtained results show that, operating conditions have a significant effect on the performance of the fuel cell. The influence of the cathode air relative humidity is more significant compared to other operating parameters. The overall cell performance is improved as the cathode air relative humidity increases as well as its temperature is decreased. The hydrogen utilization and the maximum power density are increased as the cathode air flow rate is increased. The cell electric efficiency shows values up to 65% at low current density and values around 43% at maximum power density.

3- Experimental investigation on the performance of radial flow desiccant bed using activated alumina

In the present work, an experimental investigation on the performance of radial flow desiccant bed using activated alumina has been carried out. 39.860 kg of spherical particles of activated alumina with an average diameter of 4 mm was used to form a hollow cylindrical bed with length of 90 cm and outer and inner diameters of 27.8 and 10.8 cm, respectively. During the experiments, the weight of the bed was measured instantaneously using load cell to determine the adsorbed and desorbed water during the
adsorption and desorption processes, respectively. The experimental tests were carried out at different conditions of inlet air and initial bed parameters. Temperature and humidity of air at inlet and exit of the bed were measured. The transient variation of air conditions and the bed performance is presented. The effect of bed pre-cooling on the system performance was highlighted. The obtained results show that air with inlet humidity ranging from 18.7 to 12.5 g/kg could be dehumidified, using activated alumina, to a lower level of humidity (1.2 g/kg).

4- Effect of stack orientation on the performance of H2/Air PEM fuel cell

An Experimental study has been carried out to investigate the effect of stack orientation at different cathode air flow rate on the performance of H2/Air PEM fuel cell. A 25 cm² single cell with serpentine anode and straight cathode flow channels is used. An orientation mechanism has been designed to facilitate the orientation position of the fuel cell stack. Performance of the fuel cell is characterized through analysis of the polarization and the power density vs. current density curves as well as the hydrogen utilization and the cell electric efficiency. The hydrogen flow rate, cathode air temperature and relative humidity are kept constant at 60 ml/min, 20° C and 80 %, respectively, while the cathode air flow rate values are 220, 440 and 660 sml/min in addition to the free breathing case. Obtained results show that, cell orientation has a significant effect on the performance of the fuel cell. It can be concluded that optimum cell orientation values are 30° for cathode air flow rate 220 sml/min and 90° for free breathing, 440 sml/min and 660 sml/min cases

5- Theoretical and experimental investigation on the transient coupled heat and mass transfer in a radial flow desiccant packed bed

Theoretical and experimental investigation on the transient coupled heat and mass transfer in a radial flow desiccant packed bed has been reported in the present work. An experimental test rig has been designed and constructed to carry out the required experimental measurements. System parameters and flowing air conditions (bed weight, air velocity, air conditions â€“ dry and wet bulb temperatures- at exit of test rig components) are measured and analyzed. A hollow cylindrical packed bed has been used as a desiccant dehumidifier. This configuration decreases the required power to blow air through the bed. In the theoretical study, prediction of air exit conditions from the bed is carried out based on the model of Barlow for the analysis of adsorption and regeneration processes in the desiccant bed. This model uses simple effectiveness equations for steady-state heat and mass exchangers within a finite difference procedure. Air at different conditions of temperature and humidity enters the regenerated bed and the exit temperature and humidity are plotted with time. Acceptable agreement is found between the theoretical and experimental results. The most effective parameters on the system performance are the initial water content of the bed and its initial temperature. Bed cooling during adsorption improves the system performance.