SUMMARY

After performing practical work and studying theoretical materials needed for achieving this thesis objectives and tasks I can confirm, that I:

- Learned about PEM electrolyzer's main working characteristics, performance metrics and main working mechanisms.
- Successfully investigated changing of a pH factor of a water used in a PEM electrolyzer, by performing certain experiments.
- Made conclusions confirmed by all experiments as a trend.

Firstly I have studied one of the most important value of the electrolyzer - IV characteristics. Observed and learned in practice about water decomposition voltage and determined such voltage practical value for the given PEM electrolyzer.

For the next step I started determining the most optimal and stable working voltage mode for given electrolyzer. To do that I have performed first experiment. It was to change working voltage from 1.6V to 2.2V and see how much time it will take to produce equal amount of gas. After that I have calculated energy efficiency for every experiment, which allowed me to make consequent conclusion. From the first experiment and later calculation conclusion is that the most effective and stable working voltage is in range 1.7V – 1.9V as at this voltages it takes average time to produce gas and electrolyzer has the most stable and high efficiency of 96% - 98%.

After that I have calculated faraday efficiency for each working voltage from the first experiment (1.6V – 2.2V) to determine the ratio of how much energy is contained in the produced hydrogen to the amount of electrical energy consumed to produce that hydrogen. Calculation shows that in range of voltages between 1.8V and 2V efficiency is high and more stable than on voltage levels below 1.8V or above 2V. Which almost matches with conclusion of previous calculation.

Next step was to start working with pH meter and measure the water used in the electrolyzer. Firstly, I have determined staring pH factor of water at the beginning of each experiment which turned out to be 6.7 ± 0.126. After that I have performed first experiment with the pH factor measurment. It was to measure pH factor of water after 1, 2 in the row and 3 in the row working cycles of the PEM electrolyzer. Experiment showed that there occurs significant drop of a pH factor after 1 working cycle and much less change in case with 2 and 3 working cycles, which indicates saturation. So to make conclusion was built a graph inluding only delta pH after 1 cycle. pH drop after working cycles in voltage range from 1.8V – 2V were the biggest. It means that in that cases

more hydrogen ions reacted with water, so electrolysis process was more intense. Which again coincides with previous conclusions and means that in this case experiment showed voltage range from 1.8V – 2V as the most stable and efficient.

The last variable to examine was temperature. During all experiments mentioned above I have also observed and traced temperature. Working voltages about 1.8V showed that the change in ΔpH was higher for highest observed temperature after the tests. This indicates a good agreement with behavior of energy and faraday efficiencies, i.e. most effective range of working voltage is 1.8-1.9 V

Conclusion

After performing practical part of this thesis I can make a conclusion that the most efficient working voltage modes for the given PEM electrolyzer are between 1.8 and 1.9 V. It is confirmed by all of the experiments done. It was investigated that pH factor changes the most after one working cycle of the PEM electrolyzer, and values of such pH factor drop played crucial role in making conclusion about electrolyzer's efficiency as it shows how intense electrolysis process was. Investigation of pH factor change in PEM electrolysis of water was successfully done and implemented.