DEVELOPMENT OF PROTOTYPE SOLID-STATE HYDROGEN STORAGE TANK FOR FUEL-CELL CAR

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SCHOOL OF OCEAN ENGINEERING
UNIVERSITI MALAYSIA TERENGGANU
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Lihat Sebelah

DEVELOPMENT OF PROTOTYPE SOLID-STATE HYDROGEN STORAGE TANK FOR FUEL-CELL CAR

By
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THESIS CONFIRMATION AND APPROVAL

This is acknowledged and confirmed that thesis entitled: DEVELOPMENT OF PROTOTYPE SOLID-STATE HYDROGEN STORAGE TANK FOR FUEL-CELL CAR by Ooi Ying Zhi Matric No: S39231 have been checked and all the suggested corrections have been done. The thesis is submitted to School of Ocean Engineering, Universiti Malaysia Terengganu in partial fulfillment of the requirements for the award of the degree of Bachelor of Applied Science (Electronics and Instrumentation Physics).

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I hereby declare that this thesis is the result of my own research except as cited in the references.

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DEVELOPMENT OF PROTOTYPE SOLID-STATE HYDROGEN STORAGE TANK FOR FUEL-CELL CAR

ABSTRACT

In this research, a prototype for solid-state hydrogen storage tank is being developed and used as a source supply for a fuel cell car. By using solid-state hydrogen material, the space of the tank can be minimized and provide high capacity of hydrogen gas. Therefore, this research is carried out to identify the components that are suitable to be used to assemble solid-state hydrogen storage tank system and modify it on the prototype of fuel cell car (Horizon Fuel Cell Technologies, Singapore). In this research, a suitable composition $LiAlH_4$-TiF_3 with ratio of 95:5 and 90:10 is being used as a material for solid-state hydrogen storage tank and the hydrogen storage tank system is able to heat the composition up to 100-200 °C to released hydrogen gases. The results for the output voltage from the fuel cell is being recorded and analysed based on different conditions. The difficulties faced during conducting the experiment are also discussed and suggestions was described to improve the experiment result. It has been demonstrated that the tank system could supply the hydrogen gas to a prototype fuel cell car and produce output voltage from the fuel cell. The designed system introduced could provide an early concept and knowledge before the design of the prototype fuel-cell car can be manufactured in a real scale in order to solve the environmental issues associated with burning fossil fuels.

PROTOTAIP TANGKI PENYIMPANAN HIDROGEN DALAM KEADAAN PEPEJAL BAGI KERETA SEL-FUEL

ABSTRAK

Dalam kajian ini, satu prototaip tangki penyimpanan hidrogen dalam keadaan pepejal telah dibangunkan dan digunakan sebagai bekalan sumber tenaga untuk kereta sel-fuel. Dengan menggunakan bahan penyimpanan hidrogen keadaan pepejal, ruang tangki dapat diminimumkan dan menyediakan kapasiti gas hidrogen yang tinggi. Oleh itu, kajian ini dijalankan untuk mengenal pasti komponen-komponen yang sesuai untuk digunakan bagi sistem tangki simpanan hidrogen dalam keadaan pepejal dan mengubah suai sistem tangki ini untuk prototaip kereta sel-fuel (Horizon Fuel Cell Technologies, Singapura). Dalam kajian ini, komposit yang sesuai seperti $LiAlH_4$-TiF_3 dengan nisbah 95:5 dan 90:10 telah digunakan sebagai bahan untuk tangki penyimpanan hidrogen dalam keadaan pepejal dan sistem tangki penyimpanan hidrogen ini dapat memanaskan komposit sehingga 100-200 °C untuk mengeluarkan gas hidrogen. Keputusan hasil untuk voltan keluaran dari sel-fuel telah direkodkan dan analisis dijalankan berdasarkan keadaan yang berbeza. Masalah yang dihadapi semasa kajian juga dikaji and penyelesaian telah diberi untuk memperbaiki keputusan hasil kajian. Dari kajian ini, prototaip sistem tangki penyimpanan ini telah menunjukkan bahawa ia boleh membekalkan gas hidrogen kepada prototaip kereta sel-fuel dan menghasilkan voltan keluaran dari sel-fuel. Sistem tangki penyimpanan ini diperkenalkan supaya dapat memberikan konsep awal dan pengetahuan sebelum reka bentuk prototaip kereta sel-fuel dapat dihasilkan di industri untuk menyelesaikan isu-isu alam sekitar yang berkaitan dengan pembakaran bahan bakar fosil.