

CHOOSING MATHS & SCIENCE OPENS DOORS TO A REWARDING CAREER IN HYDROGEN & FUEL CELL TECHNOLOGY



Concept of a hydrogen fuel cell

The choice of matric subjects at high school is important to young people since these subjects will shape the rest of their lives. Provided one has the aptitude, by selecting maths and science for example, a door can be opened to study science or engineering at university and then go on the work in one of the many scientific research or engineering fields that are available in the country. There is currently a major shortage of skills in the sciences. There are many opportunities, but they All start by making right choices at school.

For some time now there have been concrete steps taken by the South African Government, backed up by the private sector, to encourage learners at high schools to study maths and science subjects.



Masters and Doctor of Philosophy (PhD) studies

Students who want to study a Master's Degree in this field must be in a possession of an honours degree in either Science or Engineering. There are exciting opportunities for postgraduate students (both Masters and PhD) and in the leading-edge research field of hydrogen and fuel cell technology. Excellent academic results are rewarded by attractive bursary support at many of the universities and other scientific institutions around the country.

The criteria for these bursaries differ from institution to institution, however most require postgraduate academic records with an Average of 75% and above.

HYDROGEN & FUEL CELL TECHNOLOGIES INTRODUCTION

Hydrogen and fuel cells technology is a technology which uses both hydrogen and fuel cells to generate electricity. Hydrogen is the simplest element and most plentiful gas in the universe. It is used as an energy carrier which stores and delivers energy in a usable form. Using hydrogen as an energy carrier will reduce the country's dependence on importation of oil and also reduce greenhouse gas emissions that cause global warming. Fuel cells in the other hand directly convert the chemical energy to electricity with water and heat being the by-products. A fuel cell operates like a battery but unlike a battery, it does not run down or require recharging.

With over 75% of the world's platinum reserves (the key catalytic component of PEM fuel cells), South Africa is ideally positioned with both the raw materials and the scientific expertise to drive a developing hydrogen economy.

This may be a good choice because it could provide more scope in the research fields. For example, any of the 4 year BSc Engineering degrees incorporate honours, thus qualifying successful graduates for masters automatically. This opens the way for postgraduate studies at various universities and other tertiary institutions. It would be a good idea to look at your long term career prospects before making a final decision on subjects to take at a university or university of technologies.

UNIVERSITIES WHICH OFFER POSTGRADUATE RESEARCH PROGRAMMES IN HYDROGEN & FUEL CELL TECHNOLOGY

Several of South Africa's universities and science councils are already engaged in research on fuel-cell technologies. Three of these stand out in particular.

The University of Western Cape houses the HySA Systems Research Unit at the South African Institute for Advanced Materials Chemistry (SAIAMC). The aim of this group is to commercialize the membrane electrode assembly (MEA) and develop a direct-methanol fuel cell (DMFC) as well as hydrogen generation prototypes. The group has been involved in fuel-cell and hydrogen generation research and development for the last five years and holds seven local and international patents relating to these investigations. In the development of DMFC stack components, recent research has focused on developing platinum-group nanophasse electrocatalysts, catalytic inks and proton-conductive membranes. Novel low-cost inorganic proton-conducting membrane materials are also developed to overcome the limitations of the current Nafion polymer-based membranes, which suffer from draw-backs such as high cost, poor temperature resistance, low durability and high permeability, resulting in inefficiencies. This research effort includes innovative gas diffusion layers, MEAs and fuel-cell stack designs, with prototyping and demonstration opportunities being sought.

The HySA Catalysis Research Unit in the Chemical Engineering Department of the University of Cape Town and Mintek is involved with R&D in fuel-processor catalysts, principally for hydrogen purification. Its facilities include modern laboratories for preparation, characterization and testing of catalysts. Cross-cutting R&D activities that may be relevant to the emerging fuel-cell industry technologies are nanoparticulate catalysts of active materials and chemical catalysis.

The main focus of the HySA Infrastructure Research Unit in North West University and the Council for Scientific and Industrial Research is to deliver various technologies for hydrogen production (e.g. water electrolysis), hydrogen distribution, and hydrogen storage technologies (except solid state hydrogen storage).

WHEN DO YOU HAVE TO DECIDE ON CAREER SUBJECTS?

Learners need to decide what subjects they take for matric at the end of Grade 9. This means that they will be studying these selected subjects in Grades 10-12. Maths is a compulsory subject, however learners should choose Physical Science, which includes Physics and Chemistry if they wish to go on to university and study for a science or engineering degree. The main goal while still at school is to remain focused and ensure a good pass in the final exams so that a university exemption is achieved.

Those Grade 12's who have wisely taken Mathematics (rather than Maths literacy) and Physical Science for matric, should now consider their options after leaving school. Taking a university degree or diploma in the sciences or engineering field could be the first step towards an interesting career path in research into hydrogen and fuel cell technology.

WHAT SUBJECTS DO YOU NEED TO TAKE AT UNIVERSITY TO BE ELIGIBLE FOR POSTGRADUATE RESEARCH IN HYDROGEN & FUEL CELL TECHNOLOGY?

Choosing a career path in this exciting and fast moving discipline can be most rewarding. Once you have chosen maths and science as subjects at school, passed matric and are accepted for university or technikon education, you can go on to graduate with a science or engineering degree. It must be stressed however that very high standards are set to gain entry to some of the faculties such as Engineering or Science. Because this research fields require such a broad spectrum of disciplines one could choose any one of the Science degrees or diplomas, including Physics and Chemistry or Applied Materials Chemistry, Chemical or Mechanical Engineering, Electrical Engineering, Electronics or Metallurgy. These subjects could be useful for research in hydrogen and fuel cell technologies. However most universities offer a 4 year BSc Chemical or Mechanical Engineering degree.

WHAT IS THE FUTURE OF HYDROGEN & FUEL CELL RESEARCH?

The future of South Africa's hydrogen and fuel cell research programme is in your hands. South Africa has great potential to manufacture various components in the hydrogen and fuel cell technology product chain. This is partly because of the country's rich platinum-group metals reserves. Hence, the manufacturing of MEAs and PEM fuel cells in South Africa has the potential to create jobs and add significant value to this huge mineral resource. In order to achieve this, there is also a pressing need to attract top level postgraduates to become part of the growing research programmes at Hydrogen South Africa, universities and other institutions.

The Department of Science and Technology's (DST) Hydrogen South Africa (HySA) Public Awareness Platform is hosted by the South African Agency for Science and Technology Advancement (SAASTA).

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Andries Kruger, an MSc student at North West University, replaces the membrane of an electrolyser used in a hydrogen production process



Moisture free glove box for fabrication of components



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