THE SAFE, EFFICIENT AND ECONOMIC LARGE- SCALE STORAGE OF HYDROGEN

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COST AND DURATION
The Carbon Trust contribution towards this project is £128,400. The project started in April 2003 and is scheduled to last for 24 months.

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2002-6-263

Constant hydrogen pressure Thermogravimetric Analyser

OBJECTIVES

The purpose of this proposal is to explore novel, potentially lower-cost materials, which would offer the capability of high volumetric storage of hydrogen.

SUMMARY

It is now widely recognised that a hydrogen-based energy economy may prove to be the best long-term solution to the problems of global warming, security of fuel supply, oil depletion and inner-city pollution. Ideally, hydrogen will primarily be produced by the electrolysis of water using a range of renewable energies. As many of these sources are intermittent (wind, solar, etc), energy storage is a critical issue and hydrogen storage could be one solution. Additionally, as part of the hydrogen supply infrastructure, it will be necessary to store hydrogen on location for a range of applications; for example, vehicular fuelling stations and local/ district energy centres.

The alternatives for hydrogen storage are compressed gas cylinders, liquid hydrogen or solid-state stores. However, there are safety and security issues associated with compression and liquefaction, which may favour the use of solid-state storage (typically a low pressure technique) in densely populated, urban areas.

The current method of solid-state storage employs metal hydrides (eg LaNi5) that have volumetric storage densities higher than those of compressed gas cylinders or liquid hydrogen. However, on a large scale, such materials would represent a major capital investment, and so there is a need for much cheaper and widely available materials for hydrogen storage.

This project has: (i) undertaken a review of the hydrogen fuelling station projects around the world, to assess the various technical requirements for the on-site storage of hydrogen; (ii) studied the basic hydrogen sorption properties of potentially low-cost materials, such as carbons and zeolites. Materials synthesis techniques include High Velocity Ball Milling, with a specially designed milling pot which allows pressure to be monitored during milling (inset photograph). Characterization techniques include the use of a constant pressure Thermogravimetric Analyser (Hiden IGA), which enables the hydrogen uptake and sorption kinetics of different processed materials to be assessed.

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