Completely Integrated Solutions for the Navy

SINAVY^{CIS} PEM Fuel Cell

Considerably extended dive lengths with low-temperature fuel cells for submarines

Your Success is Our Goal

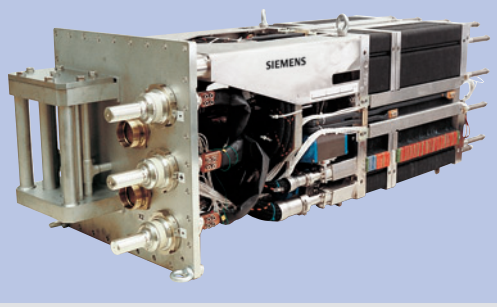
SIEMENS

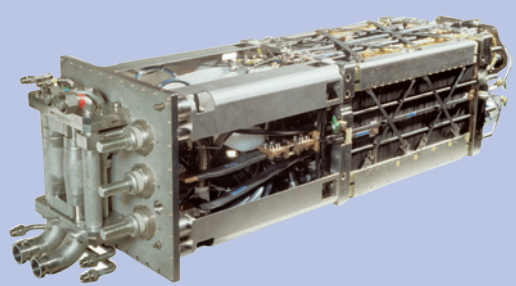
Industrial Solutions and Services

Independent from outside air, exhaust-free and silent – with SINAVY^{CIS} PEM Fuel Cell, Siemens offers a forward-looking solution to generate electrical energy on board submarines. This new technology enables the dive lengths to be considerably extended by weeks.

SINAVY^{CIS} PEM Fuel Cell – Remaining submerged longer at low noise signature

Conventional diesel-electric submarines are forced to surface at relatively short intervals in order to recharge their batteries with the diesel generators. Submarines of this design type are easily located during these phases and, as such, are very vulnerable. One of the main endeavours in submarine development has always been to make propulsion independent of outside air, because dive lengths can thereby be significantly increased.





Five good reasons for SINAVY^{CIS} PEM Fuel Cell

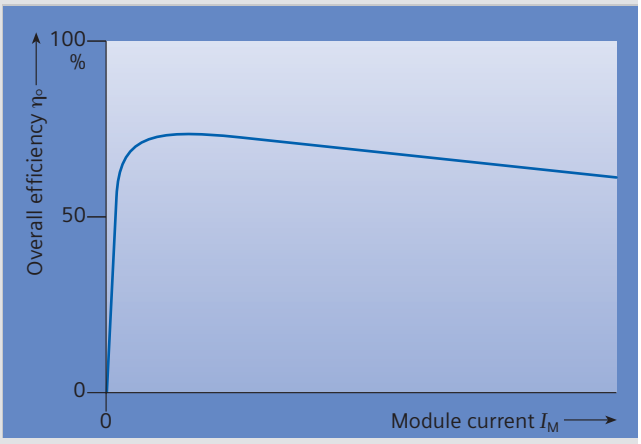
- **Dive length extension of several weeks**
- **Silent energy conversion**
- **Low stray field, non-magnetic design**
- **Greater efficiency than conventional internal combustion engines**
- **No generation of pollutants**

SINAVY^{CIS} PEM Fuel Cell – our solution in detail

Through interaction between the control system and the technical operating components of the fuel cell system, SINAVY^{CIS} PEM Fuel Cell allows for the outside-air independent propulsion of submarines. The size of the storage tanks for hydrogen and oxygen in the fuel cell system, and the required power, determine how long the submarine can remain submerged.
SINAVY^{CIS} PEM Fuel Cell covers a performance range from 30 to 120 kW. Compared with today's conventional submarines with diesel-electric propulsion, they enable an extension of the underwater deployment of several weeks.

Robust, efficient and exhaust-free

The efficiency of fuel cells is considerably superior to conventional internal combustion engines. SINAVY^{CIS} PEM Fuel Cell utilizes hydrogen and oxygen. As a result, they are absolutely exhaustfree and, beyond electricity, generate only water and heat. Thanks to the low operating temperature of maximum 80° C, the modules radiate very little heat. The comparatively low reaction consumption enables the submarine to remain submerged significantly longer.



Efficiency

Low noise signatures

On account of their electro-chemical properties, the fuel cells are absolutely silent. The required auxiliary aggregates are noise-optimized, or can be easily integrated into existing insulation modules thanks to their compact design. The noise signatures of SINAVY^{CIS} PEM Fuel Cell lies well below threshold limits.
SINAVY^{CIS} PEM Fuel Cell is designed for long-term use. If defined operating conditions are adhered to, their expected life spans many years. The robust SINAVY^{CIS} PEM Fuel Cell modules also provide benefit thanks to their extremely low maintenance needs.
At the beginning of 2004 alone, Siemens already had 5 contracts for 16 fuel cell systems based on SINAVY^{CIS} PEM Fuel Cell from European and Asian countries.

SINAVY^{CIS} – Completely Integrated Solutions for the Navy

As a comprehensive industry-specific solution for naval vessels, our SINAVY^{CIS} product family integrates all the products and services you need for sustained maximization of your ship's performance.

For each particular task, a solution has been defined that

- **horizontally** improves all of your ship's operations
- **vertically** integrates the ship's information and security management end-to-end, helping to make better-founded decisions
- and, at the same time, is designed for optimal vessel specific maintenance and comes with assured further development **over the whole life cycle**

Due to this unique combination of horizontal, vertical and life cycle dimensions, our solutions all carry the genes of an exhaustive and sustained plant productivity in their very core.

For More Stability. More Availability. More Power.

Completely Integrated Solutions from Siemens.

www.siemens.com/marine

SINAVY^{CIS} is a trademark of Siemens AG.
CIS = Completely Integrated Solutions

The information provided in this brochure contains merely general descriptions or characteristics of performance which in case of actual use do not always apply as described or which may change as a result of further development of the products. An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of contract.

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