

# Projektinformation



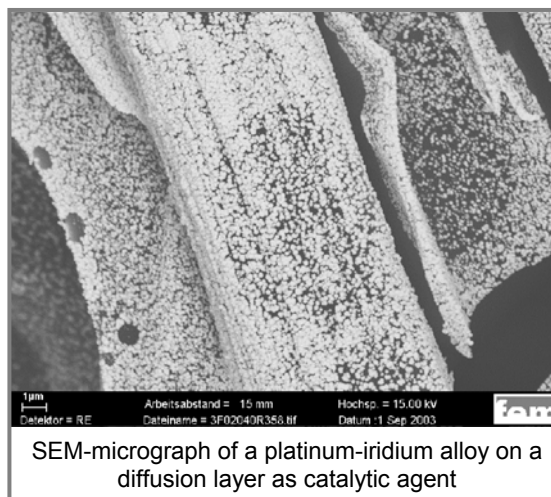
**Subject:** Application of fuel cells for the production of highly pure chemicals: Direct synthesis of deuterated hydrochloric acid from the elements

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**Project duration:** 1.4.2002 – 31.3.2004

**Project partner:** Research Institute for Precious Metals and Metals Chemistry (FEM)  
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## Project description:

In this project the application of fuel cells as chemical reactors has been pointed out: Deuterated hydrochloric acid was synthesized directly from the elements / isotopes deuterium, oxygen and chlorine by reaction in polymer electrolyte fuel cells (PEFC). One fuel cell was operated with oxygen and deuterium to produce heavy water,  $D_2O$ , a second one was operated with chlorine and deuterium to produce deuterium chloride, which, lead through the  $D_2O$ , produced deuterated hydrochloric acid.

The substitution of the “fuel gas” hydrogen ( $H_2$ ) by its isotope deuterium ( $D_2$ ) could be performed without any technical modification of the PEFC. Nevertheless, the use of chlorine ( $Cl_2$ ) instead of oxygen ( $O_2$ ) required the implementation of highly inert materials. Especially the platinum-catalyst had to be replaced by another adequate catalytic agent, as platinum is corroded and dissolved by chlorine.

Therefore, one of the main tasks in this project was the development of a suitable catalyst: It had to be resistant against the influence of a mixture of chlorine, hydrogen chloride and water at higher temperatures, and had to catalyze effectively the breaking down of the Cl-Cl binding in the chlorine molecule. Elements of the group of the platinum metals are the only materials, which seemed to be suitable for this purpose: Platinum-based alloys with other appropriate platinum-metals as components, e.g. iridium, exhibit higher corrosion-resistances than the pure platinum metals.

Alloys of the platinum metals were prepared on diffusion layers by electrodeposition by the project partner FEM, whereas these layers were tested by IUTA in a small PEFC with respect to their catalytic properties. Corrosion-testings of the alloys were performed in the laboratories at FEM. These systematic experimental investigations lead to the development of an iridium-based catalyst, which was used in modified PEFC's to produce deuterated hydrochloride acid as described above.

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