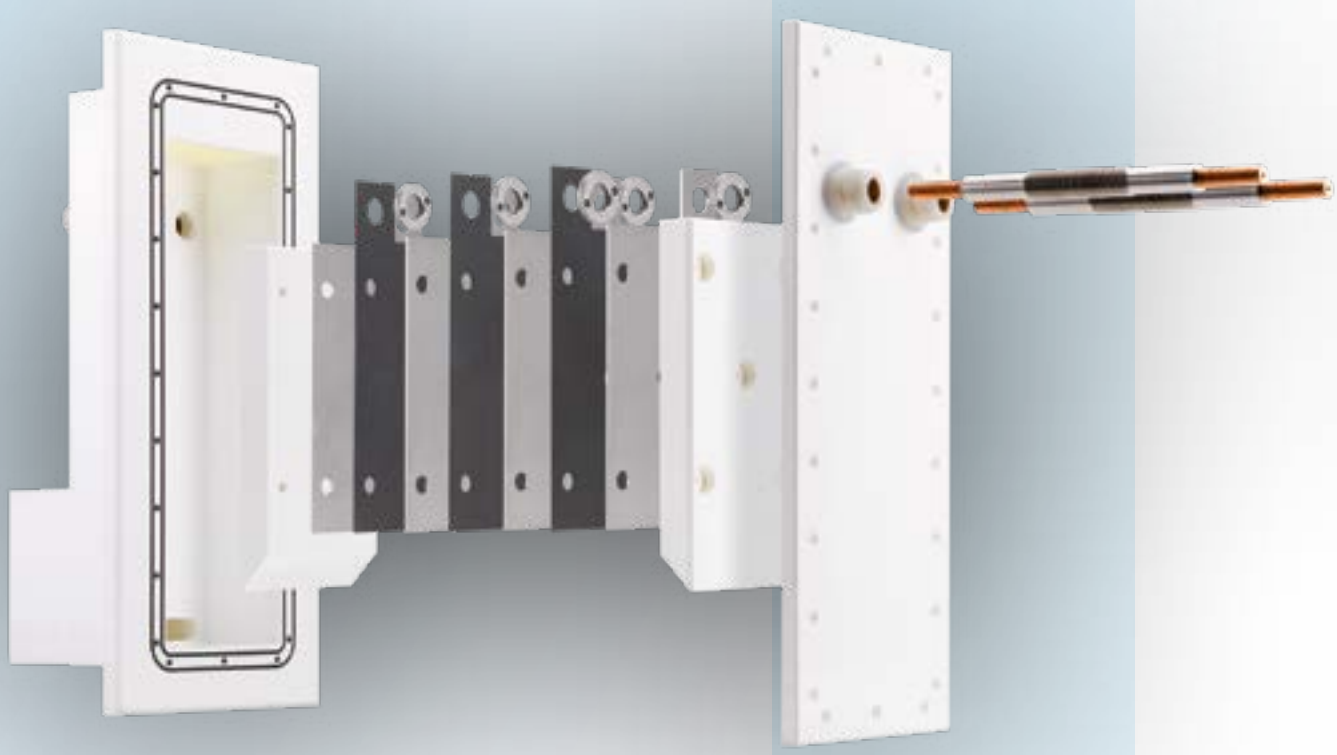
Diamant für extreme Beanspruchungen

Boron doped

Diamond Electrodes

for water treatment and synthesis



We make crystalline diamond

A touch of diamond ...

A few micrometers thick layer of innumerable small diamond crystals cover the surface of the diamond electrodes and thus make them an outstanding material for electrochemistry.

They have the largest known electrochemical potential window of all electrode materials. This leads to a high current efficiency and makes many electrochemical reactions at all possible. Only diamond electrodes with almost 100% current efficiency manage to generate $OH^{\cdot}$ radicals directly from the water. Through this, a very effective and clean electrochemical water treatment (disinfection or COD reduction) without additional chemical is possible (Advanced Oxidation Process).

Due to their large potential window, diamond electrodes are also interesting for the electrochemical synthesis. In many cases, new or significantly improved methods are possible for the production of substances.

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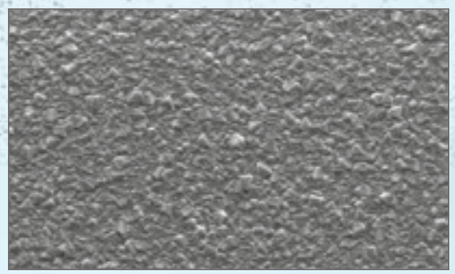
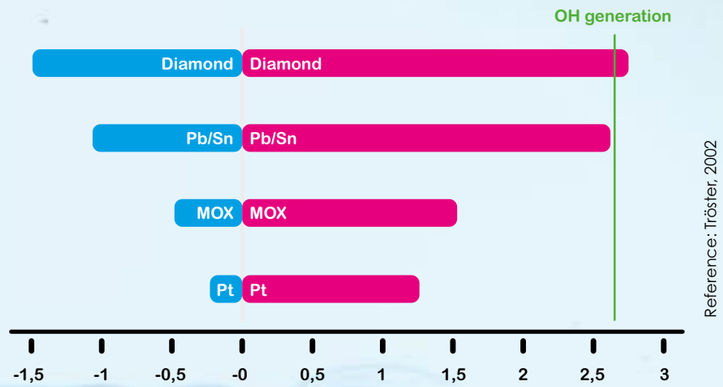


SEM image of a diamond layer

Electrode materials in comparison

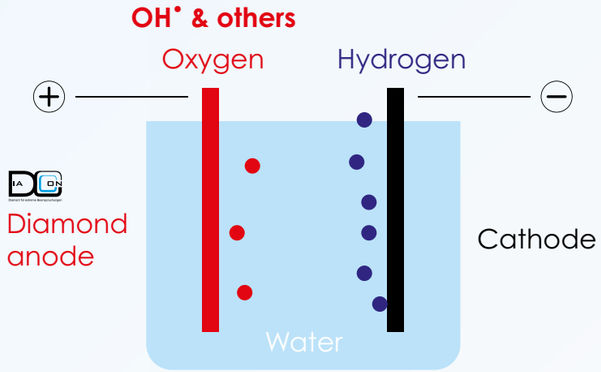


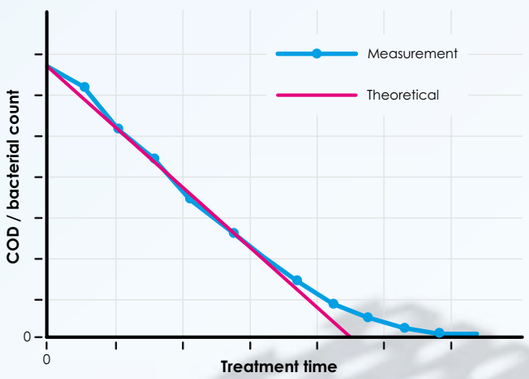
Reference: Tröster, 2002

Electrochemical water treatment & synthesis

Advanced oxidation

Diamond electrodes make it possible to clean highly polluted wastewater flows without adding further chemicals. Thanks to electrolysis, powerful oxidants, in particular the highly reactive hydroxyl radical (OH•), are produced with great efficiency on the diamond anode. This OH• radical unspecifically destroys even the most resistant molecule structures (cold combustion).





COD-removal

OH• radicals enable the complete mineralisation of even extremely stable organic pollutants (e.g. also PFAS). This makes it possible to treat even very tough wastewater flows effectively. The required plant technology is simple and manageable.

Wastewater treated with diamond anodes

Reference: FAU Erlangen-Nürnberg; Institut for material science WTM

Electrochemical synthesis by Diamond electrodes

Due to the high overpotential required for water splitting, diamond electrodes can be used for both cathodic and anodic synthesis reactions. Anodic reactions are particularly relevant for the synthesis of peroxide compounds (e.g. persulfate). Cathodic reactions are also being discussed, such as the reduction of CO_2 to formic acid.
In addition to these outstanding properties, diamond electrodes are non-toxic and can replace expensive precious metals (e.g. Platinum).

$P_2O_8^{4-}$

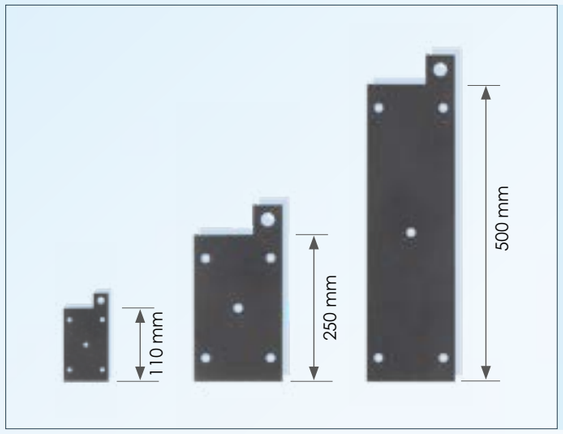
CH_2O_2

H_2O_2

$S_2O_8^{2-}$

DiaCCon

Diamond Electrodes



Standard electrode
Type Susi/Bärbel/Barbara

Dimensions:

110 mm x 73 mm / 250 mm x 150 mm / 500 mm x 150 mm
(without connection tab)

Active electrode surface: 160 cm^2 / 750 cm^2 / 1500 cm^2

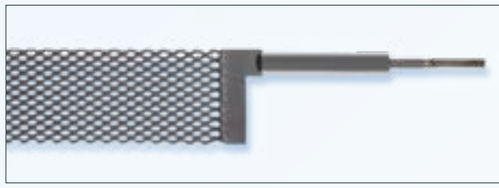
Coating thickness: ≥ 12 µm

Silicon based electrodes

Dimensions: 250 mm x 180 mm

Active electrode surface: 750 cm^2

Coating thickness: ≥ 12 µm

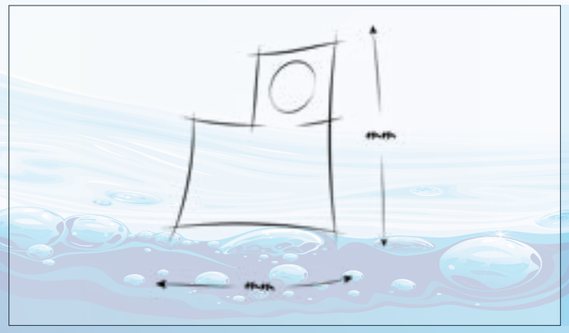


Mesh electrodes

Mesh electrodes of various types with or without welded connection elements

Welded electrodes

Exceptional large electrodes or complex geometries are produced by welding.



Custom-made electrodes

custom-made electrodes of various geometries, economic production by water jet cutting

Diamond electrodes for system manufacturers or systems with diamond electrodes

… always from DiaCCon!

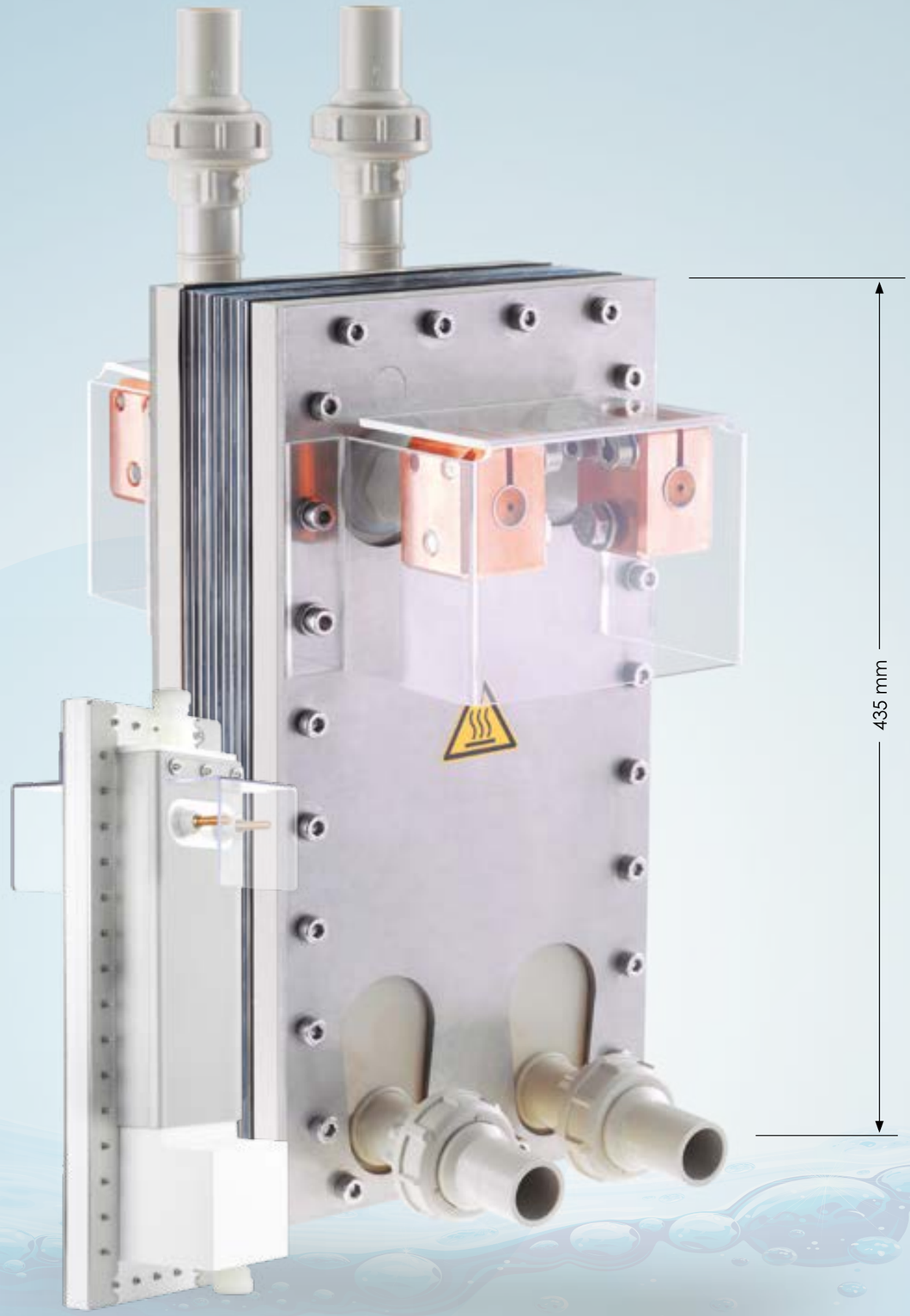
For system manufacturers:

DiaCCon supplies diamond electrodes for clean-up work in Fukushima

The company **ICUS (formerly EICC)** has set itself the task of treating radioactively contaminated oil/water mixtures and has chosen advanced oxidation with diamond electrodes from **DiaCCon** as the cleaning process. The system with 20 square meters of diamond electrodes has now successfully gone into operation and is playing a part in the **FUKUSHIMA DAIICHI** decommissioning project.

In systems from DiaCCon:

DiaCCon also offers ready-made electrolysis systems with diamond electrodes. These range from small experimental setups to larger systems with several square meters of electrode area. For very large systems, we work with appropriate system manufacturers.
Appropriate electrolysis processes (e.g., water purification) can be developed either at **DiaCCon** or with external partners.



Electrolysers

We also offer ready-made electrolysers for our standardized electrodes. These are available both as simple and robust monopolar setups and as electrolyzers divided into anode and cathode compartments. For our silicon-based diamond electrodes, there is a special variant that is suitable for the material properties of silicon.

Standard Electrolyser

For our standard electrode types we offer complete electrolysers. These are compact components which can be easily integrated in your systems. In addition to the variants with stainless steel cathodes, also reversible-polarity designs are available. The modular design allows anode areas of 0.016 up to 0.90 sqm per electrolyser.

Electrolyser for silicon-based diamond electrodes

Due to silicon's special properties as a material, we have developed a specially customised electrolyser for these electrodes to ensure easy handling.

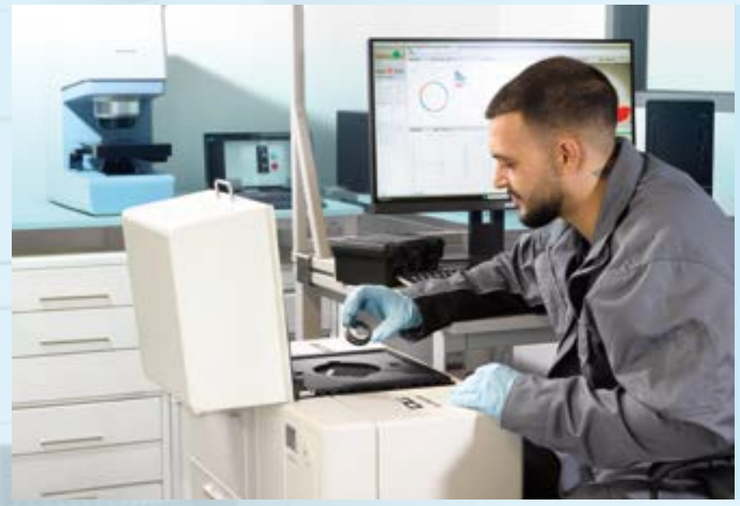
Split Electrolyser

For sophisticated electrochemical processes, we offer a split electrolyser based on our standard electrodes. Both membranes and separators can be used. This is particularly interesting for the development of processes using green electrochemistry.

Quality Control at DiaCCon

Our Quality Control includes all the necessary measuring equipment to ensure that our products are delivered in perfect condition.

With our **Light microscope**, we can determine both the diamond crystal size and its shape. This gives us important information about the properties of the diamond layer and its quality.



We use **Tropel Flatmaster** to precisely measure the flatness, for example, of mechanical seals in the nanometer range. The mechanical seals are measured before and after coating to guarantee the best results.

With our **Beta-Scope** we can easily and quickly determine the exact coating thickness of our diamond electrodes. None of our electrodes leave our premises without having been precisely measured.

With the **FTIR Spectrometer**, we can analyze complex compositions and also draw conclusions about the quality of the diamond layer. It is mainly used in the quality control of our diamond coatings.

DiaCCon

"our tool is the hot filament"

DiaCCon is a worldwide leading company in the field of CVD diamond coating. We specialise in high quality diamond coating of mechanical seals / bearings, and the production of long-term stable diamond electrodes.

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We make crystalline diamond

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