METAKEM

Anodes

Electrolytical treatment of drinking and swimming pool waters

Treatment is done

- for the removal of chalk in drinking water and
- for the disinfection of drinking and swimming pool water.

Removal of chalk

Natural waters always contain calcium and magnesium carbonates, which cause problems in the piping system, valves etc. by precipitation. The pipes are gradually getting blocked, valves and taps become difficult to open or close, all electrical devices for heating water become more and more inefficient. Most coffee machines are actually killed by calcareous deposits.

There are certain areas where chalk is a main problem for the municipal water supply, and therefore efforts are made to extract the chalk already in the community water storage vessel or at least before entering the distribution lines.

When doing electrolysis oxygen is evolved on the anode, leaving behind H+ ions and the surrounding of the anode renders more acid. At the cathode hydrogen is evolved leaving behind OH - ions and rendering the surroundings of the cathode more alkaline. This enables the chalk to precipitate on the cathode. The chalk deposit on the cathode can only be dissolved by an acid or by a polarity reversal. Depending on the smoothness of the cathode the polarity must be reversed not only for a few minutes but for half an hour or more.

Platinised titanium and mixed metal oxide coated titanium are mostly used for electrolysis in this field. Polarizing it cathodically is always reducing the lifetime of an anode. When using platinum coatings on titanium, the platinum is not really attacked but hydrogen may enter through the platinum coating into titanium and form titanium hydride. This might loosen the adhesion of platinum on titanium. We have not observed platinum flaking off at a current density of 8 A/dm² and current reversal every 15 min for one year. With mixed oxide coatings one has in the cathodic mode, a reduction of the iridium oxide and the permanent polarity change reduces the life of a mixed metal oxide coating remarkably, sometimes drastically. Platinum has the disadvantage that it can come to spontaneous recombination at the catalytic platinum surface with danger of detonation in closed systems and the presence of oxyhydrogen.

Because of this danger mixed metal oxide coatings are used despite the shorter life. Meanwhile compounds with an optimized life have been evaluated and it has been found, that the mode of polarity change also affects the life of the mixed oxide coatings. It is better to decrease slowly to zero-voltage, to rest there for several seconds, before slowly increasing the voltage in the opposite direction.

Further developments might go to conductive cathodes, which are not affected by hydrogen and have a smooth surface to reduce the time of polarity change. It has been found that at very low current densities and at a steady flow of water through the electrode the chalk will not stick to the cathode. The quantity of anodes necessary for this process is very high. If there is a chance to use a higher current density with a perfectly smooth cathode surface, the treatment of the chalk problem by the communities might become more interesting and all small installations to eliminate chalk will no longer be necessary.

Disinfection of drinking water

Water disinfection is normally made by using chlorinators or by adding hypochlorite, which works perfectly when the water is running or soon consumed. Many old water supply systems have a higher level of bacteria and germs, as the germs penetrate the chalk deposit. Therefore decentralized disinfection systems are interesting. On ships or airplanes water is filled into tanks and the amount of bacteria at the moment of use is unknown. In hotels the water may stand for days in the pipes, when a room is not being occupied. This problem increases for warm water (legionella), where the bacteria have optimal growing conditions.

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