In the chemical industry, corrosion is usually a reaction to avoid, as it leads to damage to equipment, pipes, and other parts. Therefore, it is often tried with great effort to prevent corrosion processes by using, for example, stainless steels. The term corrosion is generally understood as a change in the material properties through a reaction with the environment.

In addition to weathering processes and biocorrosion, special attention is paid to so-called chemical corrosion in industry. The most well-known chemical corrosion process is the rusting of iron by oxidation with oxygen. Corrosion reactions are influenced by many parameters, such as temperature. This year’s ChemCar of TU Dortmund uses the corrosion of a copper cable to control the distance.

**Motivation**

To control ChemCar using corrosion, a corrosion reactor is used. The original voltaic pile consists of several galvanic elements. The anode and cathode are surrounded by two electrolytes (copper sulfate and sodium sulfate) which are separated by a membrane. By adding the copper sulfate electrolyte, copper is formed instead of hydrogen at the cathode. The following reactions take place at the respective electrodes:

- Anode reaction: $\text{Zn} \rightarrow \text{Zn}^{2+} + 2e^-$
- Cathode reaction: $\text{Cu}^{2+} + 2e^- \rightarrow \text{Cu}$

**Voltaic Pile**

The original voltaic pile consists of several galvanic elements. Each element is composed of a copper sheet, water and a zinc sheet. In a voltaic cell, a zinc plate serves as the anode and a copper plate as the cathode. Since no copper ions are given, hydrogen forms at the cathode instead of copper. In order to avoid the creation of hydrogen, the concept was changed.

**Battery**

The battery consists of several individual voltaic cells connected in series (voltaic pile). The cathode and the anode are surrounded by two electrolytes (copper sulfate and sodium sulfate) which are separated by a membrane. By adding the copper sulfate electrolyte, copper is formed instead of hydrogen at the cathode. The following reactions take place at the respective electrodes:

- Anode reaction: $\text{Zn} \rightarrow \text{Zn}^{2+} + 2e^-$
- Cathode reaction: $\text{Cu}^{2+} + 2e^- \rightarrow \text{Cu}$

**Collecting Pan**

In the event that a chemical leaks out of the reactor or out of the battery, collecting pans are attached around all the components in which liquids are present.

**Termination Reaction**

The Corrosion Reactor consists of a Teflon part and a glass bowl. In the Teflon part, five copper wires with a diameter of 0.09 mm are clamped. The top of the glass bowl is connected to the dropping funnel. Additionally, the glass bowl contains an exhaust air opening and an opening for air supply.

**Valve with Abrasive Contact**

To close the electric circuit and add the nitric acid at the same time, a abrasive contact is used. The electric circuit is closed only at a certain position of the valve.

**Electric Motor**

To change the electric energy into kinetic energy an electric motor is used. The motor works at 0.32 A and 11 V and has a Power of 3.5 W.

**Exhaust Filter**

The resulting nitrogen oxides are passed through a exhaust filter before leaving the reactor room. As a result, the resulting nitrogen dioxide are disproportionated.