Corrosion protection for galvanic elements/macroelements

A galvanic cell (also known as a battery) is formed through a direct mechanical connection between different metals or metals of the same kind in different environments. If a current also flows through a connecting electrolyte (water, concrete or earth), the baser component will corrode.

Macroelements or galvanic cells are unintentionally built into many metal pipeline systems, for example, pipeline cellars in drinking water reservoirs. The corrosion process arising from this can very quickly limit the operation of the system or stop it from working altogether. This can be prevented by taking simple measures to protect against corrosion.

Where two different metals are found in the same electrolyte (earth, water, etc.) and are also connected to each other electrically, the baser metal will corrode. This composition is known as a galvanic cell. The noble metal functions as the cathode and the baser metal as the anode. What is commonly known as "rusting", in other words the disintegration of the metal, takes place on the anode. When a baser metal is introduced intentionally to protect the underlying system, this is called a sacrificial anode. This technique was already in use more than 100 years ago to protect the hulls on ships. The same principle is still implemented today to protect against corrosion in marine technology as well as in most hot-water boilers.

The galvanic cells referred to above often form unintentionally through the use of, for example, chromium steel pipes and cast-iron fittings without the use of appropriate electrical separations. The galvanic cell becomes active as soon as the existing internal coating on the cast-iron fitting becomes damaged. In this case (small anode – large cathode), the area ratios are highly unfavourable, leading to very fast-progressing corrosion. Straightforward electrical separation of the two metals can prevent the corrosion process from occurring. Separation is ensured by using insulating flanges or couplings.

The formation of soft brown patches can be detected on the mortar surface in many drinking water tanks, occurring very close to earthed chromium steel fixtures (e.g. pressure doors). No full scientific explanation has yet been found for this phenome-

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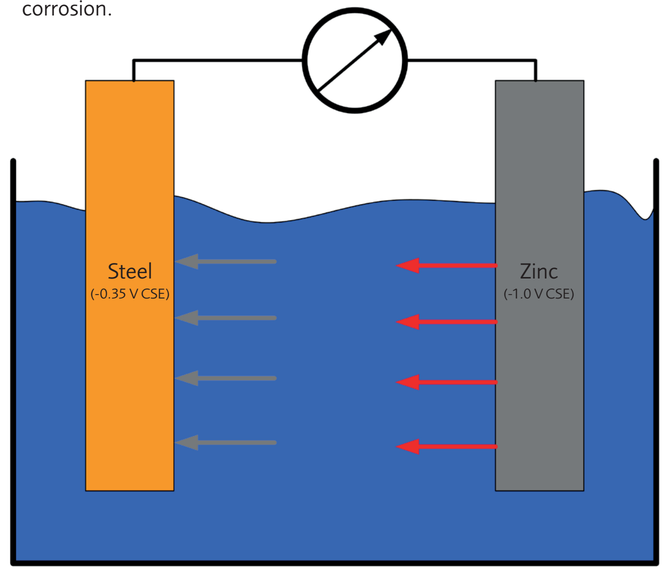
A cast-iron fitting separated using insulating sleeves

Soft brown patches near chromium steel fixtures

The base zinc metal dissolves, thereby protecting the steel against corrosion.



Functional principle of a galvanic cell (battery)

non. However, many completed projects have shown that electrical separation can significantly improve the situation. That's why it is important to make sure that no accidental contacts occur between the chromium steel and the reinforcement rod when installing pressure doors.
A certain degree of discrepancy arises between corrosion protection and ensuring that systems are safe. In order to guarantee safety, metallic surfaces larger than 1 m^2 or pipelines longer than 6 m need to be connected to a potential equaliser. This direct connection does, however, negate the separation of metals. Connecting the earthing cable via a separating unit (antiparallel diodes) to a potential equaliser blocks the corrosion currents but still allows overvoltages to be discharged if necessary to ensure safety.
In practice, a variety of metals are often used in one pipeline system, making an overriding corrosion protection concept essential.

Experience

Our team has over 40 years of combined first-hand experience. So whatever the application, we can draw on an enormous amount of expertise.

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