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WORKING PRINCIPLE OF ZINGA

(Electro - Galvanizing Protection)

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The basic principle by which Zinga offers protection to other metals is the cathodic protection principle obtained by means of sacrificial electrodes. The principle is based on the fact that one metal (zinc) is sacrificed to protect another metal (steel).

By corroding, metals release electrons and positive ions (cations) according to the schematic reaction:

$$Me \rightarrow Me^{z+} + z\, e^-$$

The electrons formed in this way are consumed by another reaction which in many cases is the reduction of oxygen, according to the following reaction:

$$O_2 + 2H_2O + 4\, e^- \rightarrow 4\, OH^-$$

In turn, the hydroxyl ions (OH^-) will react with the metallic cations of opposite charge to form a new and poorly soluble compound according to the following reaction:

$$x\, Me^{z+} + y\, OH^- \rightarrow Me_x\, (OH)_y$$

This is how steel gets covered with the ferrous compound FeO.OH better known as "RUST".
If one were able to extract the electrons required for the reduction of oxygen from another metal than iron, the corrosion of iron could be stopped while the other metal will be obliged to dissolve and consequently to produce the electrons necessary for the reduction process. Such a metal can for instance be zinc.
The entire process is illustrated on the enclosed illustration. On the left side the corrosion reaction of iron is seen, on the right side one can see the reaction of zinc while protecting the iron.

The illustration makes it also quite clear that there should be a conductive contact between zinc and iron without which the passage of the electrons formed by the dissolution of zinc to the iron electrode could not be achieved.

In the case of massive zinc, like hot-dip galvanizing, there is no problem for the passage of the electrons within the zinc layer itself and between the zinc layer and the steel.
In the case of zinc powder the amount of zinc and its granulometric distribution in space must enable the perfect electric conductivity between the zinc particles and the steel surface. The electrons which are formed at the zinc/medium interface, where the zinc can dissolve, must indeed be able to be transferred to the steel.
If the zinc particles were not in contact with each other, the electrons could not be transported and there would be no protection at all.
This explains why the dry zinc film requires at least 92 % of zinc. Higher concentrations, as is the case of Zinga (96 %), increase the protective action even when the coating thickness is the same.
The electrochemical action of ZINGA can easily be shown by means of the test described below:

A low carbon steel plate is carefully scoured, (grease, oil, rust, etc. have to be removed) in order to obtain a clean surface.
The centre of the plate is covered lengthwise with a strip of tape in such a way that it will easily be removed afterwards. Next, the total surface of the plate is painted with ZINGA. After having allowed the coating to dry for a period of time which is recommended by the manufacturer, the tape is removed, leaving the plate divided in three sections : two painted ones and an unpainted part. The plate is immersed into an electrolyte (e.g. tap water, salt solution ...) and left for a certain period of time. For comparison, another plate, which was not treated at all was also immersed in an identical solution. The enclosed picture gives an idea of the results obtained by such a test. On the left side picture one can see the plate which was not covered with ZINGA and which was left for 24 hours in water containing 2 % NaCl.
The pictures on the right show the plate with the three sections. Obviously no corrosion has occurred in the central, unprotected part, of the specimen.

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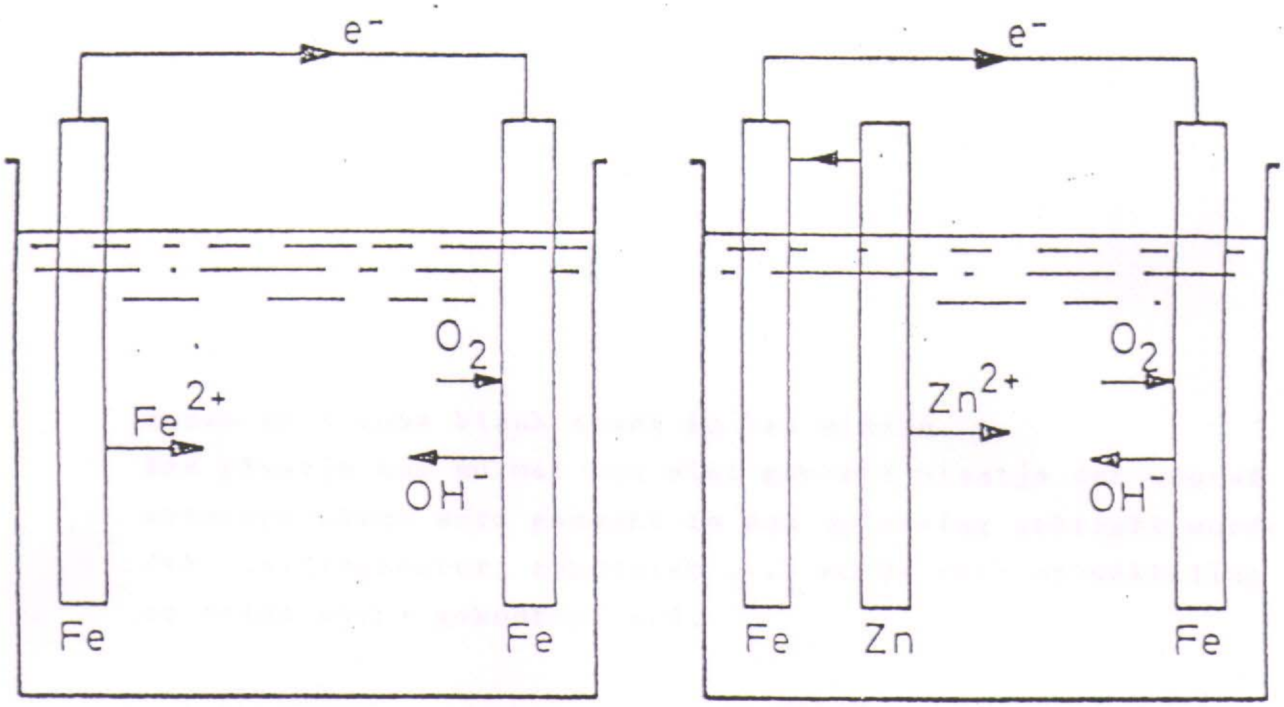
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O2
Fe2+
OH⁻
Fe
Fe
e⁻
Zn2+
O2
OH⁻
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Zn
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