

REPAIR AND MAINTENANCE OF STEEL REINFORCED CONCRETE STRUCTURES BY SIMULTANEOUS GALVANIC CORROSION PROTECTION AND CHLORIDE EXTRACTION

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00 CONTENT

- 01 PRINCIPLE**
- 02 CONCEPT**
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- 04 REFERENCE PROJECTS**
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01 PRINCIPLE

Corrosion of Steel Reinforcement

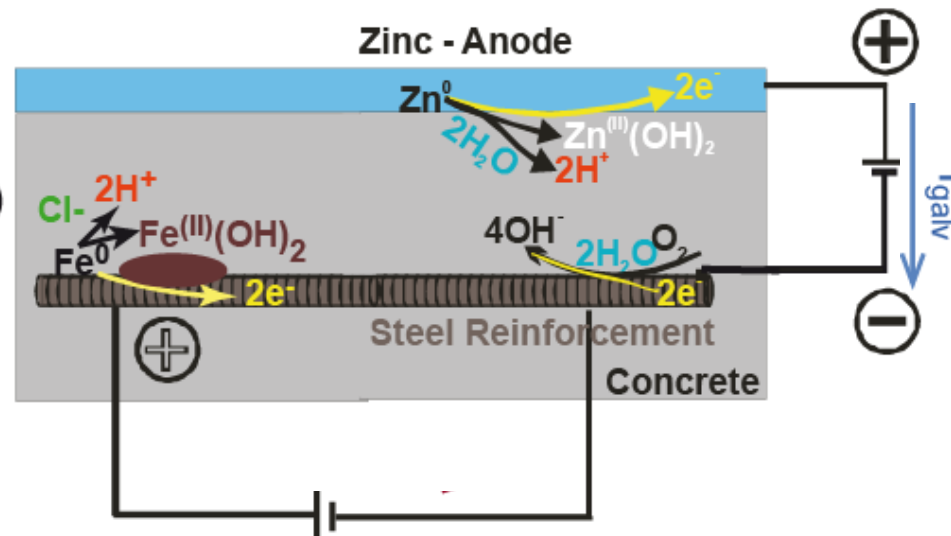
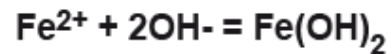
Iron - Air Battery

Galvanic Corrosion Protection

Zinc - Air Battery

$$E^0_{\text{Fe/Fe(II)}} = -0,61 \text{ Volt}$$

$$(\text{pH} \leq 9, c_{\text{Fe}^{2+}} = 10^{-6} \text{ mol/l})$$

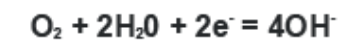


$$E^0_{\text{Zn/Zn(II)}} = -1,25 \text{ Volt}$$



$$\Delta E_{\text{real}} = 0,4 - 1,2 \text{ Volt}$$

$$E^0_{\text{O}_2/\text{OH}^-} = +0,34 \text{ Volt (pH 11)}$$



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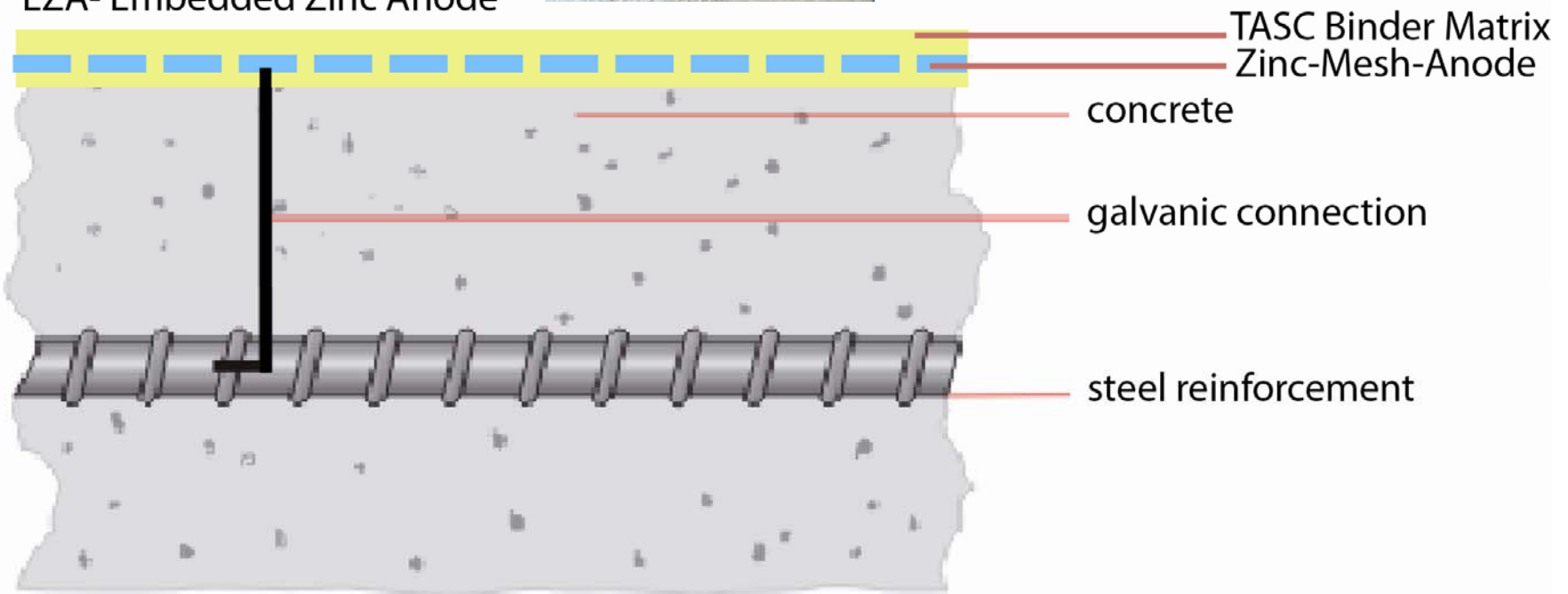
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02 CONCEPT



EZA – Embedded Zinc Anode

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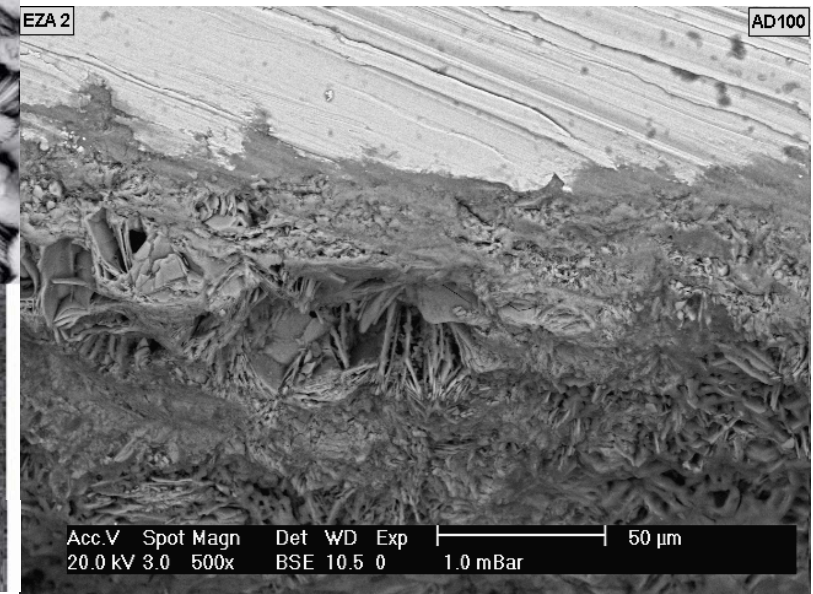
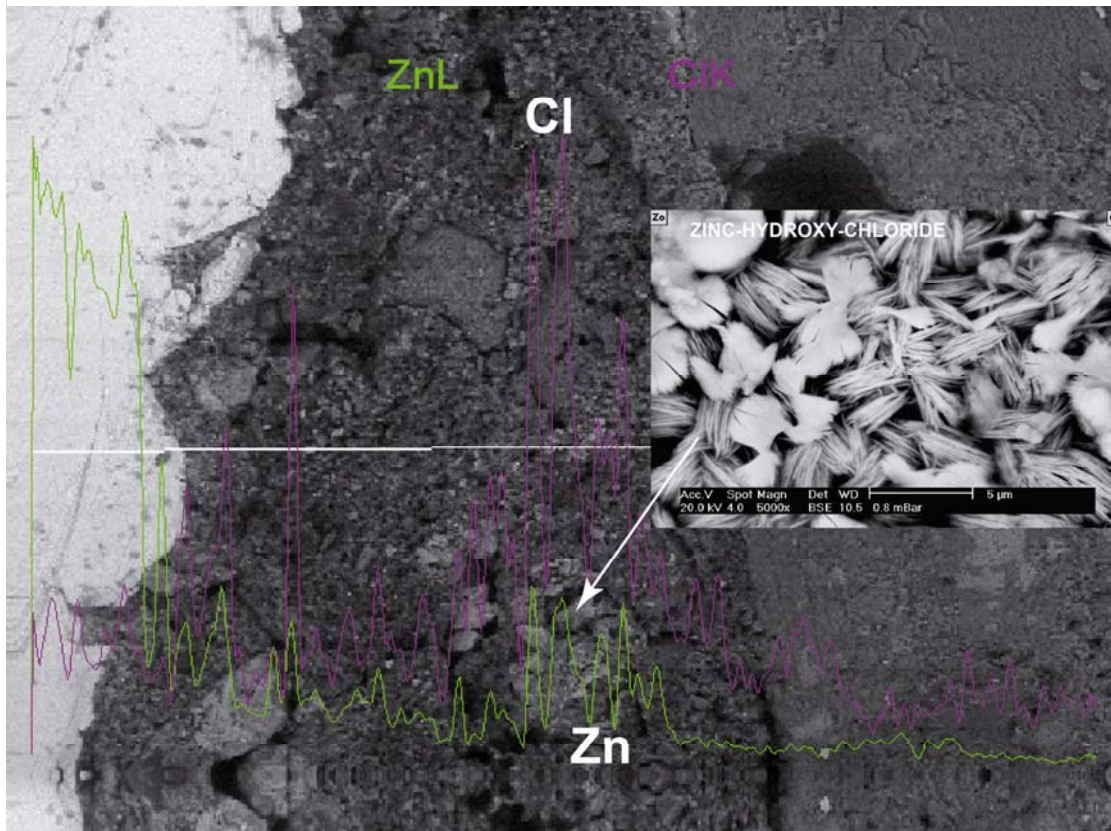
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02 CONCEPT

Chloride Extraction:

Chloride, migrated to the zinc-anode is immobilized within the EZA-binder as zinc-hydroxy-chloride, a natural mineral **Simonkolleite**



03 Pilot Study – Alplgraben Bridge



EZA – Embedded Zinc Anode

Alpl Graben bridge in Styria, Austria

**In the Styrian Alps at an altitude of
1000 m above sea level**

System installed October 2007

Start of Operation November 2007

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03 Pilot Study – Alplgraben Bridge



Alpl Graben bridge in Styria, Austria

Total area protected: 50 m²

- start up November 2007
- monitoring & control by
LE-DAC system – 20 mW power
requirement
- automated 24 h depolarization
measurements
- resistant less measurement of
macro cell currents (efficiency of
corrosion protection)

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04 Reference Projects

04.1 Alplgrabenbridge

During the general rehabilitation of the Alplgraben bridge June – August 2012, the EZA system, applied on the abutment, was coated with a acrylic coating



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04 Reference Projects

04.2 Hubertus Viaduct Den Haag



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04 Reference Projects

04.2 Hubertus Viaduct Den Haag



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04 Reference Projects

04.3 De Meerenbrugg Bridge Utrecht



Corrosion protection of the
abutments of the

De Meerbrugg Steel bridge over
the Amsterdam-Rijn canal in the
Netherlands

with the TAS-EZA system

Installation April 2010

Total 200 m², 4 kg Zn/m²

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04 Reference Projects

04.3 De Meerenbrugg Bridge Utrecht



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04 Reference Projects

04.4 Parking Deck in Saas-Fee



In Saas Fee in Switzerland, no cars are allowed,

Cars have to be parked in parking deck with a total of 60'000 m² of parking area

The parking deck was erected 1979/80 and extended 1981/82

The decks are made from prestressed concrete

Chloride content 0,5 – 3,0%

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04 Reference Projects

04.4 Parking Deck in Saas-Fee

EZA installed in cooperation with Sika Services AG (CH)

August 2011 on 30 m² (1 parking box) for demonstration purposes



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05 CONCLUSIONS

- The EZA System proved to protect steel reinforcement reliably and durably
- Expected service time of an EZA with 2 kg Zinc/m² Steel is about 15 years
- Chloride extraction of EZA coated with a water impermeable membrane (e.g. acrylic coating) extracts chlorides from the concrete cover and immobilizes them efficiently within the EZA-matrix
- The EZA allows reliable protection and rehabilitation of RC structures at about 50% of the cost of conventional concrete repair

CHARACTERISTICS OF the EZA – SYSTEM

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THANK YOU FOR YOUR ATTENTION