

MORTIERS SPECIAUX

# Lanko REPAIR system



TREATMENT OF CONCRETE STRUCTURES  
EXPOSED TO REBAR CORROSION

**PAREX LANKO**  
ENDUITS-COLLES-MORTIERS



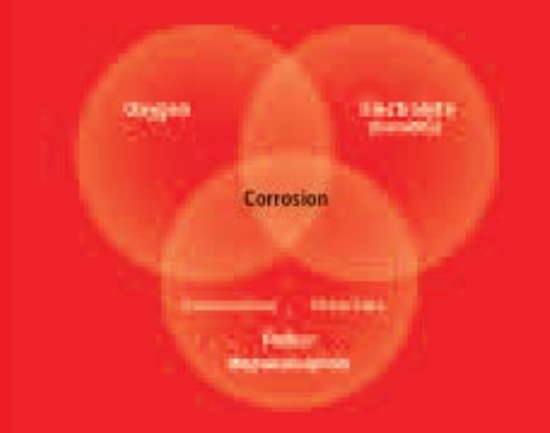
# How does steel become corroded?

Concrete, a heterogenous, fine blend of cement, aggregates, water and admixtures is a living material; it does not have an easy life however, being exposed to extreme weather conditions and having to cope with the harsh realities of the modern world.

Deterioration caused by corrosion of steel rebars is responsible for 80% of problems encountered.

Steel rebars become corroded in the presence of three key factors (see diagram right).

In order to reduce or halt corrosion, one of these three causes must be eliminated.

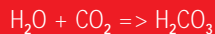


## Rebar depassivation:

Steel corrosion occurs when the pH of concrete falls below 9. There are two possible instigators of this pH drop:

- **Carbonation**, in the presence of water.

Reaction between water and carbon dioxide:



Formation of carbonic acid which brings the pH level down.

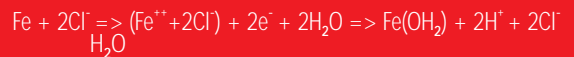
Followed by reaction with lime :



As soon as the carbonation front reaches the rebars, the steel corrosion process begins.

- **Chlorides**, from de-icing salts, sea water or setting agents containing calcium chloride.

These react with iron:



Rebar corrosion begins when the  $[\text{Cl}^-]/[\text{OH}^-]$  exceeds 1.

Once this ratio has been reached, acid compounds are formed, triggering corrosion. With the  $\text{OH}^-$  ions coming for the most part from the concrete, the  $[\text{Cl}^-]/[\text{OH}^-]$  ratio of 1 is equivalent to a chloride content of 0.4% of the cement weight.

## Corrosion currents:

Corrosion processes are generally of an electrochemical nature.

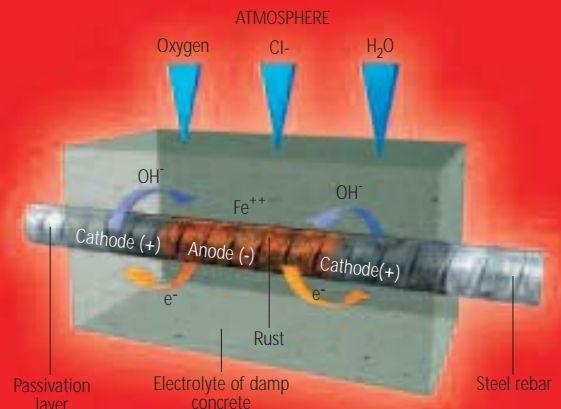
In the presence of a conductive liquid (electrolyte), steel rebars, depending on their composition and their exposure, may cause a potential difference and produce an electric current.

The part of the metal which constitutes the corroded zone is known as the Anode (-)

The part of the metal which constitutes the NON-corroded zone is known as the Cathode (+)

On contact with water, iron, in the anodic zone, is transformed into solution and produces 2 electrons.

In the cathodic zone, water, oxygen and the electrons interact and produce  $\text{OH}^-$  anions or hydroxide ions.



# Rehabilitati

## Treatment of corrosion

Treating corroded steel rebars in reinforced concrete using an impregnating corrosion inhibitor.

### 761 LANKOSTEEL

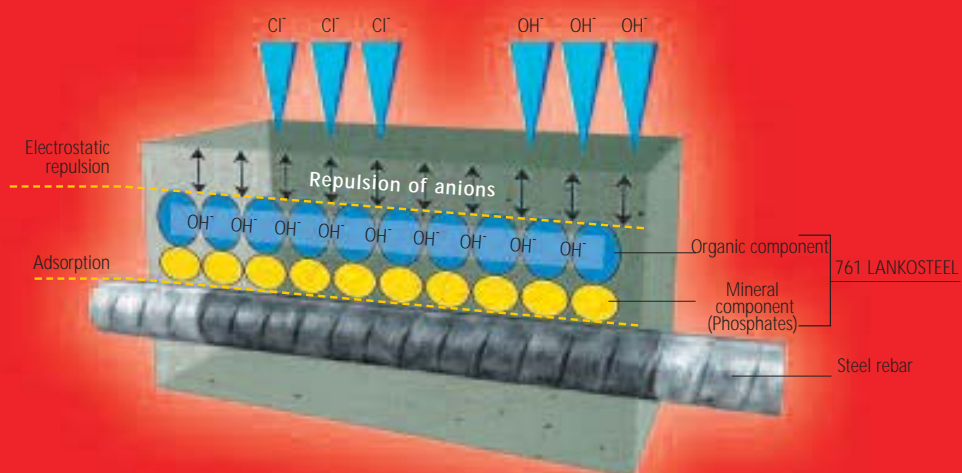
Organo-mineral impregnating corrosion inhibitor for concrete which is carbonated or contaminated by chlorides.

- Chemical base: phosphate solution in aqueous phase.
- Fast concrete penetration.
- Solvent-free.
- Does not form a film.
- Does not alter the appearance of concrete.
- Concentration required on rebars:
  - Carbonation = 0.001% of concrete weight.
  - Chlorides = % of Cl in relation to concrete weight.

If the Cl- rate is over 1%, do not apply.



#### Reaction mechanism:



*The mineral component of 761 LANKOSTEEL adheres to steel by adsorption (phosphatization). The organic component creates a negatively charged repulsive barrier which wards off the aggressive ions, which are themselves also negatively charged.*

# on of reinforced concrete

## Concrete repairs

A complete range of hydraulic repair mortars for all types of concrete structures



**730 LANKOREP Fin**  
**731 LANKOREP Structure**

Structural repairs to concrete elements

- Pillars
- Slabs
- Poles
- Posts
- Vaults
- Dam aprons and spillways
- Tunnels
- Bridges...



**732 LANKOREP Façade**

Repairs to concrete building facades

- Balconies
- Terraces
- Walls
- Overhangs
- Cornices...
- Can be painted over after just 24 hours.



**733 LANKOREP Blanc**

Repairs to architectonic concrete

- Balconies
- Terraces
- Overhangs
- Cornices...
- Can be tinted to match the colour of the original element.

# Concrete structures with LANKOREP

the LANKOREP range



## 734 LANKOREP Patrimoine

Repairs to concrete heritage-listed structures

- Old buildings
- Historical monuments
- Churches
- Buildings
- Factories
- Sculptures
- Low modulus
- Possibility of adding colour and/or filler.

## 735 LANKOREP Rapide

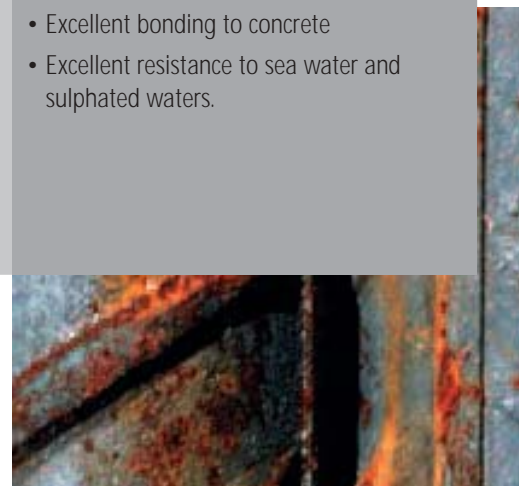
Rapid repairs

- Pillars
- Slabs
- Poles
- Vaults
- Dam aprons and spillways
- Elements in tidal zones.

## 737 LANKOREP Fissure

Repairs to fine cracks in concrete

- Injection to fine cracks > 0.5mm
- High mechanical strength
- Excellent bonding to concrete
- Excellent resistance to sea water and sulphated waters.



# REPAIR SYSTEM

## Structural protection

Preventive treatment against future aggression of concrete.

### 230 LANKOSTOP

#### Water-repellent inhibitor

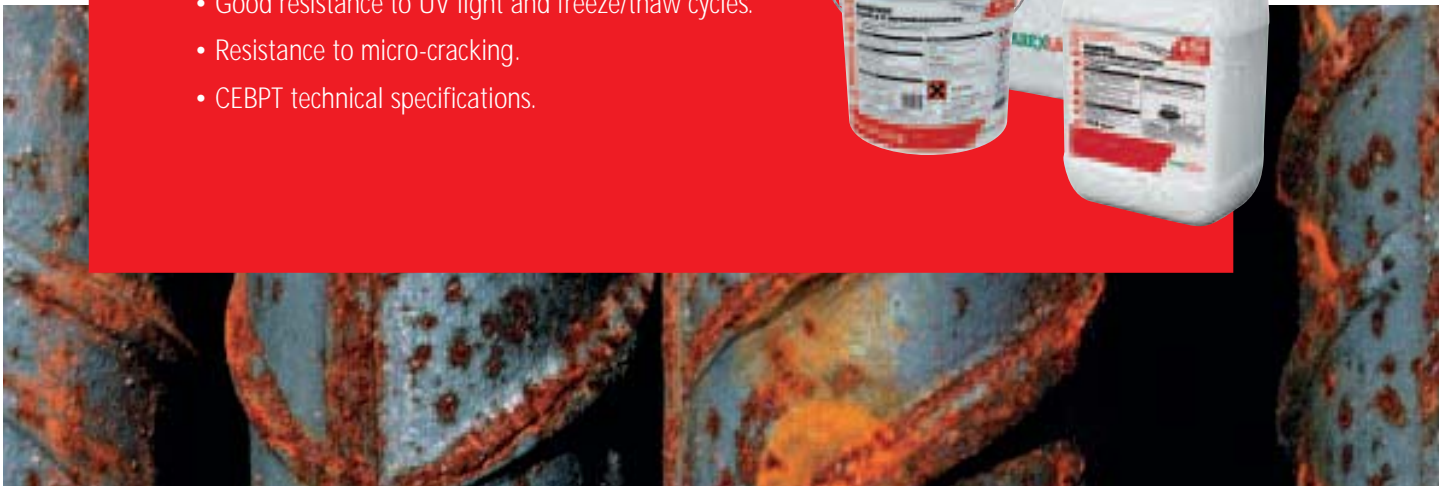
- Protection of concrete against water, CO<sub>2</sub>, chlorides and sulphates.
- Chemical base: fluorinated and silanated acrylic in aqueous phase. Contains a corrosion inhibitor.
- Reinforces the action of 761 LANKOSTEEL.



### 228 LANKOLASTIC

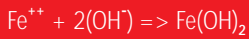
#### Flexible waterproofing mortar

- Protection and waterproofing of concrete elements.
- Excellent resistance to sea water, sulphated water and de-icing salt.
- Significantly reduces carbonation by protecting against CO<sub>2</sub>.
- Good resistance to UV light and freeze/thaw cycles.
- Resistance to micro-cracking.
- CEBPT technical specifications.



### Oxides formed:

The OH- anions combine with the Fe<sup>++</sup> cations to form ferrous hydroxide according to the following formula:



Then, in the presence of water and oxygen, ferric hydroxide is formed according to the following reaction:



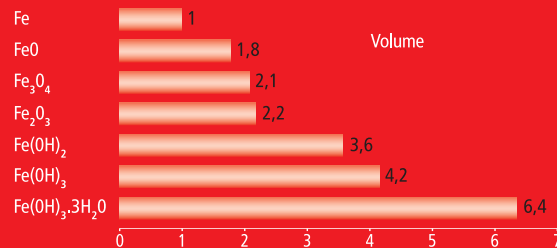
These oxides take up a greater volume than the steel and provoke tensions within the concrete, leading to splintering and shattering of the latter.

### The battery effect:

When repairing a reinforced concrete structure presenting signs of corrosion, the damaged areas around the rebars are eliminated, the layer of rust is removed from the rebars and then a new quantity of mortar is applied to reconstitute the original shape. This mortar, alkaline by nature, provides the steel rebars with their original level of protection.

The concrete areas adjacent to the repair area remain contaminated by the aggressive agents (carbonates, chlorides...).

**Inhibitors make it possible to treat the entire disorder, by limiting the need to remove surrounding concrete to the visibly damaged areas.**



Thus, around the repaired zones, cathode zones once more, new anode zones are formed.

The medium term consequence of this polar change is an acceleration of the corrosion process in the zones adjacent to the repaired area.

To prevent this problem, it is essential to treat the entire structure.

# Corrosion inhibitors acting by impregnation

### Definition according to ISO 8044:

"A chemical substance that decreases the corrosion rate when present in the corrosion system at a suitable concentration, without significant reaction

with the components of the environment".

### Reaction mechanisms:

Inhibitors can be classified into 3 groups according to their reaction mechanism:

#### Group 1 – Adsorption inhibitors:

The product forms a film by adhering to the surface of steel. This film acts as a barrier against polluting agents. Does not provoke a chemical reaction with steel.

#### Group 2 – Oxidising inhibitors:

The product protects steel by forming a compact film of iron oxide. The product requires oxygen in order to be effective and must be precisely measured.

#### Group 3 – Non-oxidising inhibitors:

The product forms an electrochemical barrier on the surface of steel. Does not provoke a chemical reaction with steel.





The sustainable preservation of our concrete heritage requires a comprehensive solution...

The **LANKO REPAIR SYSTEM**, based on a 3-step concept:

- **Curative corrosion treatment,**
- **Concrete repairs,**
- **Protection against future aggression,** provides such a solution.

**Sample references:**

- Arsenal, Cherbourg
- Atmospheric cooler, Dampierre en Burly
- Listed church, Herrlisheim
- Grau St Ange Bridge, Port Barcarès
- Apartment buildings, Carouges (Switzerland)
- Road tunnels:
  - Mont Blanc
  - Fréjus
- Channel Tunnel
- ...

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