

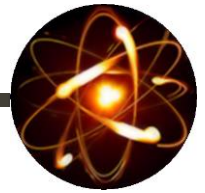


# CATHODIC PROTECTION

## Lexi-Hybrid Impressed Current Cathodic Protection



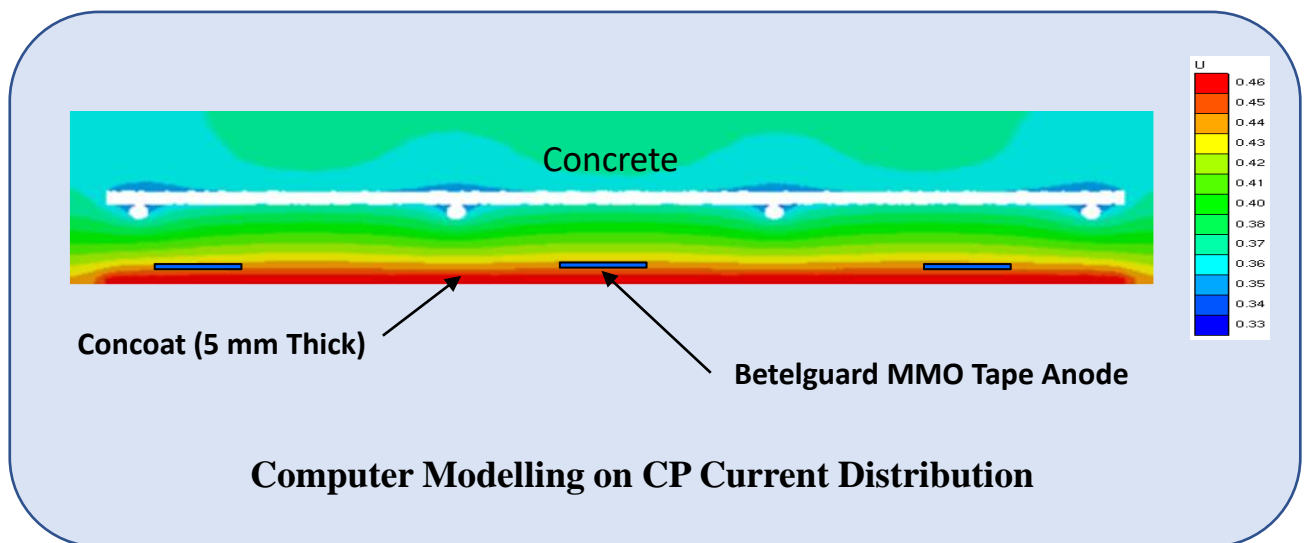
*Concrete Structures*



**Lexi-Hybrid Impressed Current Cathodic Protection (ICCP) System** is the most advanced system for concrete structures to control rebar corrosion by chlorides or carbonation. This CP system includes both features of expanded titanium mesh with concrete overlay (“surface anode”) and slotted ribbon mesh (“line anode”).

**Betelguard MMO Titanium Tape Anode** is a key component for **Lexi-Hybrid Impressed Current Cathodic Protection (ICCP) System** for reinforced concrete structures. It is composed of a precious metal oxide catalyst sintered to specially designed thin titanium tape substrate.

**Concoat** is the semi-conductive concrete mortar which is applied over the Betelguard MMO Titanium Tape Anode system to spread the CP current to the entire concrete surface uniformly. Since the semi-conductive nature, the risk of electrical short circuits is eliminated.



## Features

- Highly cost effective
- Simple installation without the extensive experiences by a contractor
- Quick and low cost installation – no need for cutting or drilling concrete
- No risk of electrical short circuit, causing the malfunction of CP system
- High performance due to the uniform CP current distribution to the entire structure
- Developed high bonding strength in a short period of time (Min. 1 MPa)



## Applications

- Marine structures (jetties, wharves, seawall, caisson, etc.)
- Buildings, balconies • Bridges • Cooling towers • Intake structures
- Viaducts • Box culverts • Parking garages
- Concrete structures not exposed to rain or water splash  
(tunnels, deck soffits, indoor, etc.)

## Anode Material Specifications

### Betel Guard Titanium MMO Tape Anode

Width:	-----	20 mm
Thickness:	-----	0.05 or 0.07 mm
MMO type:	-----	Iridium Oxide Base
Substrate:	-----	Grate 1 Titanium (ASTM B265)
Electrical resistance (100 m):	-----	0.04 & 0.07 ohm
Expected life (NACE Standard TM02944-94):	-----	Min. 50 years at 150 mA/m <sup>2</sup>
Max. anode current rating at 150 mA/m <sup>2</sup> :	-----	3 mA/m
Short term limited anode current density:	-----	220 mA/m <sup>2</sup>
Pressure sensitive adhesive (option):	-----	Acrylic Foam

### Titanium Conductor Tape

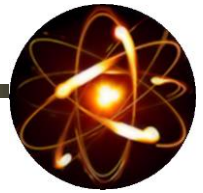
Width:	-----	20 mm
Thickness:	-----	0.07 mm
Material:	-----	Grate 1 Titanium (ASTM B265)

### Concoat

Shrinkage:	-----	0.015% at 28 days
Electrical resistivity:	-----	100 to 1,000 ohm-cm
Application thickness:	-----	5 mm (nominal)
Expected life:	-----	Min. 40 years (20 mA/m <sup>2</sup> on concrete)



Betelguard Titanium Tape Anode with  
Pressure sensitive adhesive



# Installation Procedure



1. Surface preparation by high pressure water



2. Attachment of Betel Guard MMO Titanium Tape



3. Connecting all MMO tape anodes to titanium conductor tape using spot welding.



4. Applying Concoat to finish the CP anode system. (right: hand trauanting, right: spray)



THIS MONTH: CORROSION OF HIGHWAYS AND BRIDGES  
CONCRETE STRUCTURE CORROSION

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NACE INTERNATIONAL

CATHODIC PROTECTION

Cost Effective Cathodic Protection System for Concrete Structures

Mr. Fawcett, MUI International, West Chester, Pennsylvania, Todd Sells and Denis McInerney, S&L, Inc., Barrie, Ontario, Canada

A thin layer of semi-conductive material was developed and combined with mixed metal oxide (MMO) coated titanium tape anodes for cathodic protection (CP) of reinforced concrete structures. This system overcomes several problems experienced with existing CP systems, including poor CP current distribution caused by near-short circuits and shallow concrete cover, acid generation at the anode-concrete interface, and dryness of the anode-concrete interface for some structures. Simplified engineering of the anodes and installation provide a more user-friendly and cost-effective approach.

Since 1988, cathodic protection (CP) has been recognized as the most effective method for controlling corrosion of reinforcing steel in durable, uncoated concrete structures. Various CP systems have been used in over 30 countries. However, significant challenges have limited the use of this powerful technology.

Obstacles to CP System Effectiveness

**Industry Problems**

- CP is often not recognized as the most effective means to control steel corrosion.
- The initial expense of applying CP systems is high. Savings realized over the lifespan of the structure are often not factored into the cost/benefit analysis.
- CP systems are often not locally available.
- CP system complexity deters many local contractors.
- CP system maintenance is perceived as too burdensome because it is unfamiliar to owners.

**Engineering Problems**

- Some engineers design the CP systems without regard for construction methods.
- Some engineers design CP systems without consideration of long-term performance.
- Inexperience can lead to CP system designs that are not practical to install.
- Many CP designers copy the drawings and specifications from old projects without regard to requirements/differences in the new applications.

**Technical Problems**

- CP current distribution can be inadequate when non-uniform distribution.
- Excessive current density (CD) generates acid at the anode-concrete interface.
- Certain cementitious materials are inappropriate for use with CP.

32 NOVEMBER 2014 MATERIALS PERFORMANCE NACE INTERNATIONAL VOL. 33 NO. 11

Introduced by NACE International Magazine



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