

# Zinc Paint for Impressed Current Cathodic Protection System of Reinforced Concrete

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## Corrosion: 4% Annual Loss of World's Gross Domestic Product (GDP)

### Introduction

- Corrosion of steel in concrete is one of the **biggest durability** issue for reinforced concrete (RC) structure leading to its reduced sustainable design life.
- Impressed Current Cathodic Protection (ICCP)** is considered to be the most proven and effective approach and in some cases, the only rehabilitation technique for preventing and minimizing corrosion initiation in chloride rich environment in RC structures<sup>1</sup>.
- Industry is still looking for an alternative anode material for ICCP, with easier and faster installation technique and better performance characteristics.
- This research evaluates the feasibility of **zinc rich paints (ZRP)** as an anode to provide ICCP to RC structures.
- The proposed ZRP anode system will be a **low cost, low carbon footprint, have high efficiency** and can be easily applied by roller or brush.

3m long beams coated with ZRP for polarization test



### Aim and Objectives

To develop specialist conductive coating anode system which is low cost, low carbon footprint and highly efficient for impressed current cathodic protection of steel in concrete structures

- To use zinc paint as anode and evaluate its performance to understand its mechanical, electrochemical behavior and its efficiency to cathodically protect chloride contaminated structure
- To optimize the current density required for cathodically protecting reinforced concrete using ZRP as anode material.
- To study microstructure of zinc paint and zinc-concrete interface before and after CP.

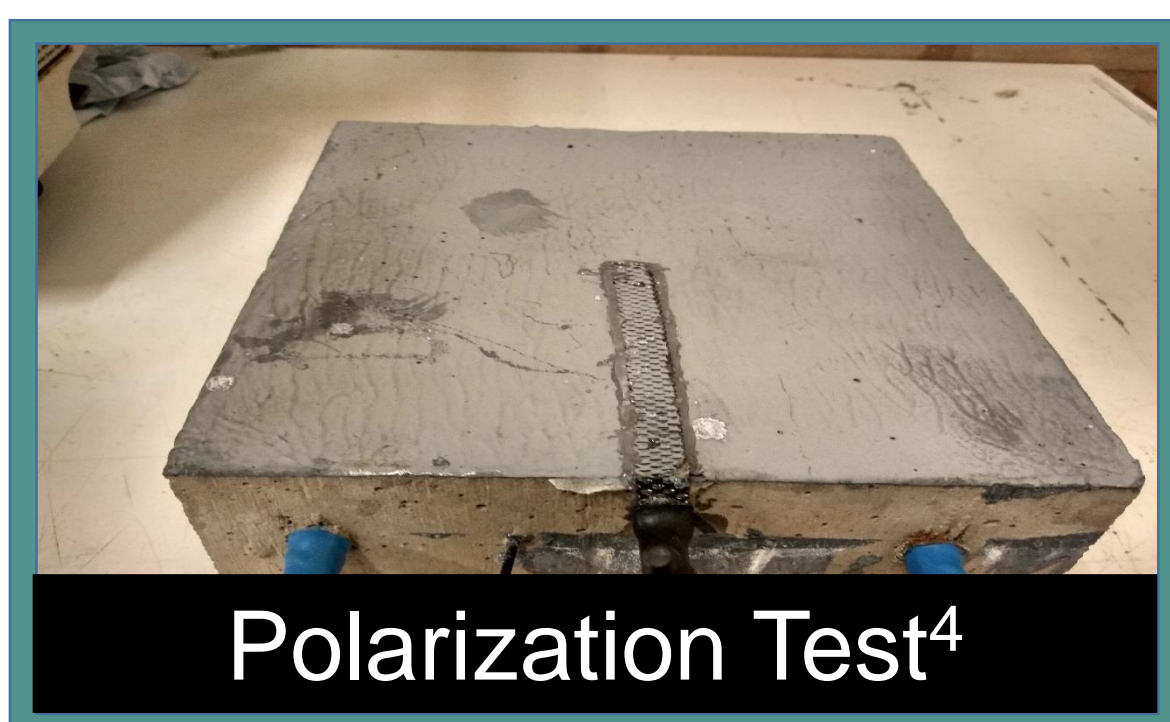
### Experimental Plan



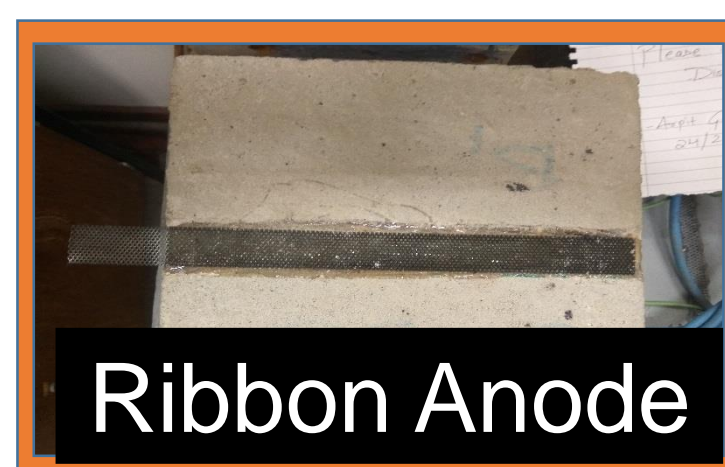
Conductivity Test<sup>3</sup>



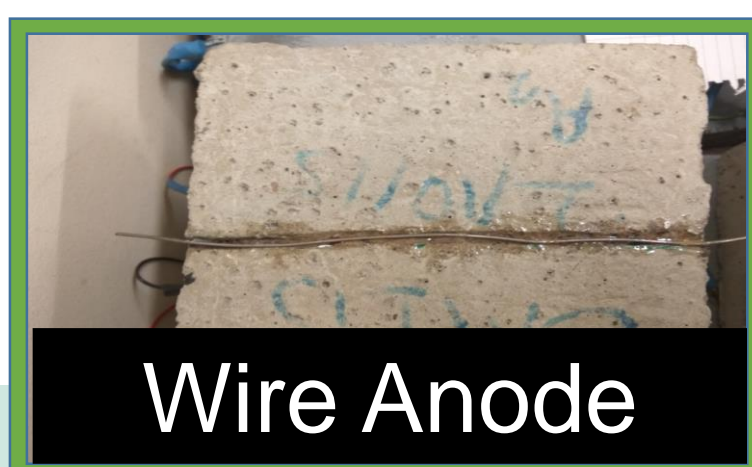
Bond Test<sup>2</sup>



Polarization Test<sup>4</sup>

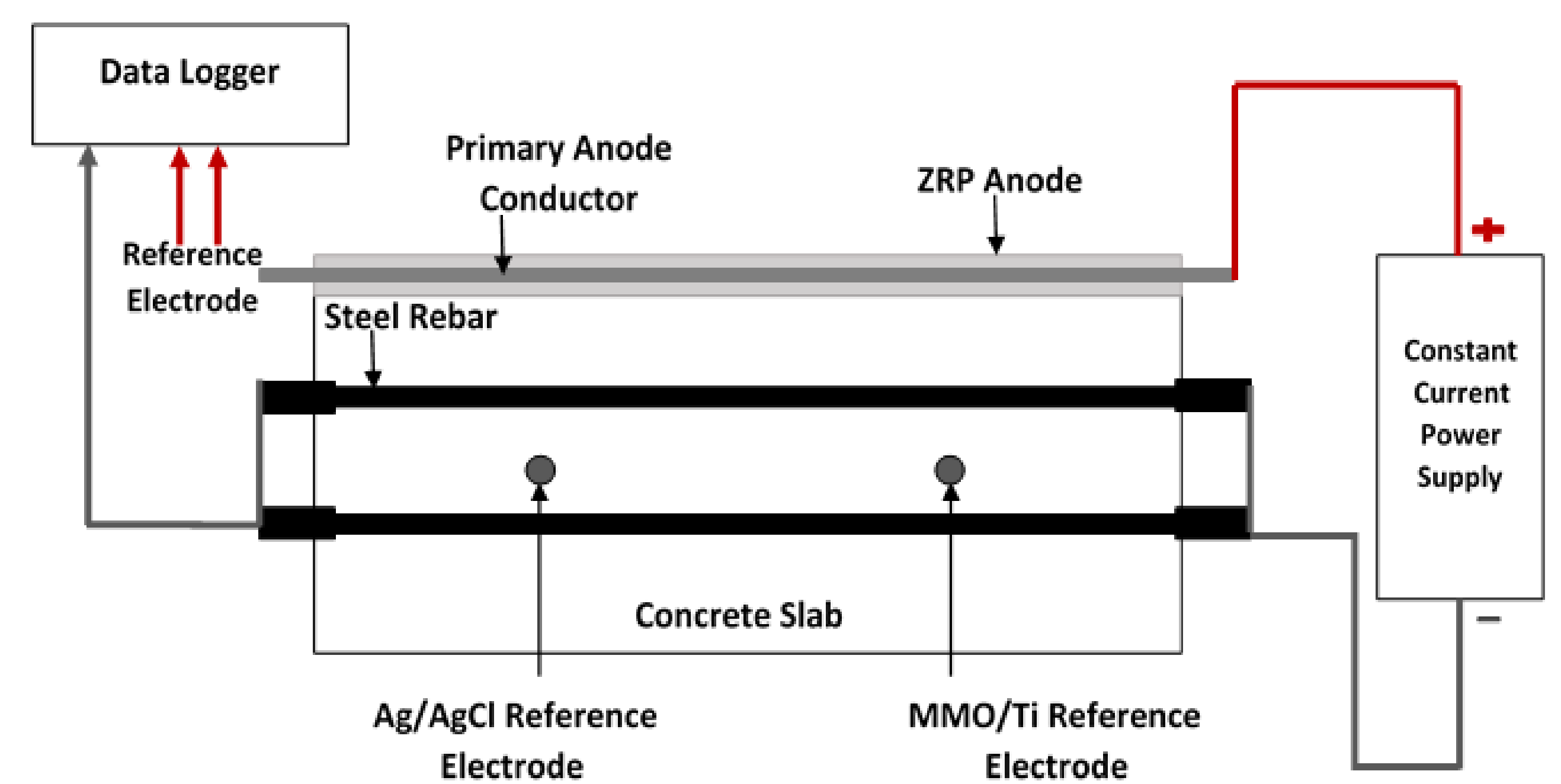


Ribbon Anode



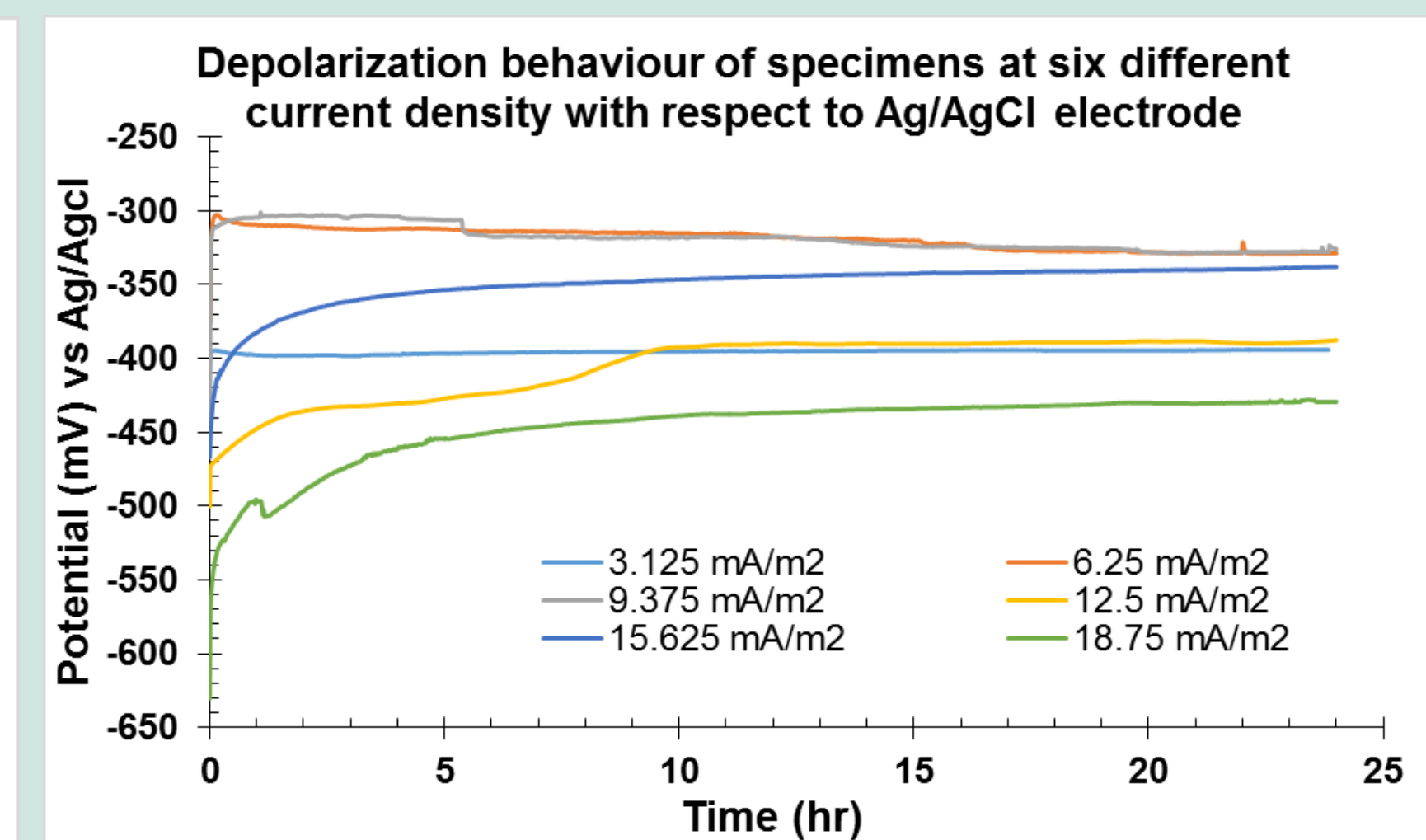
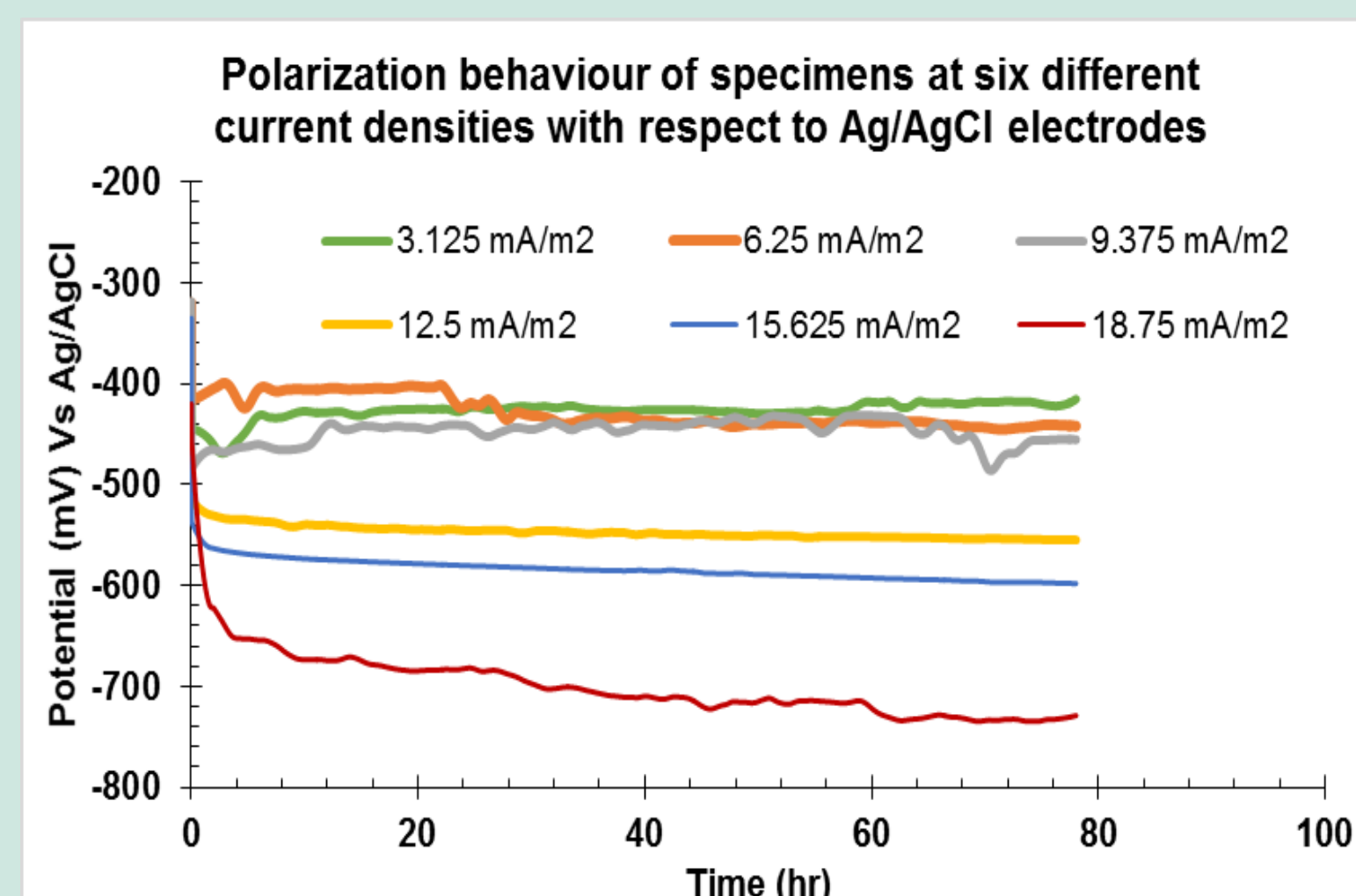
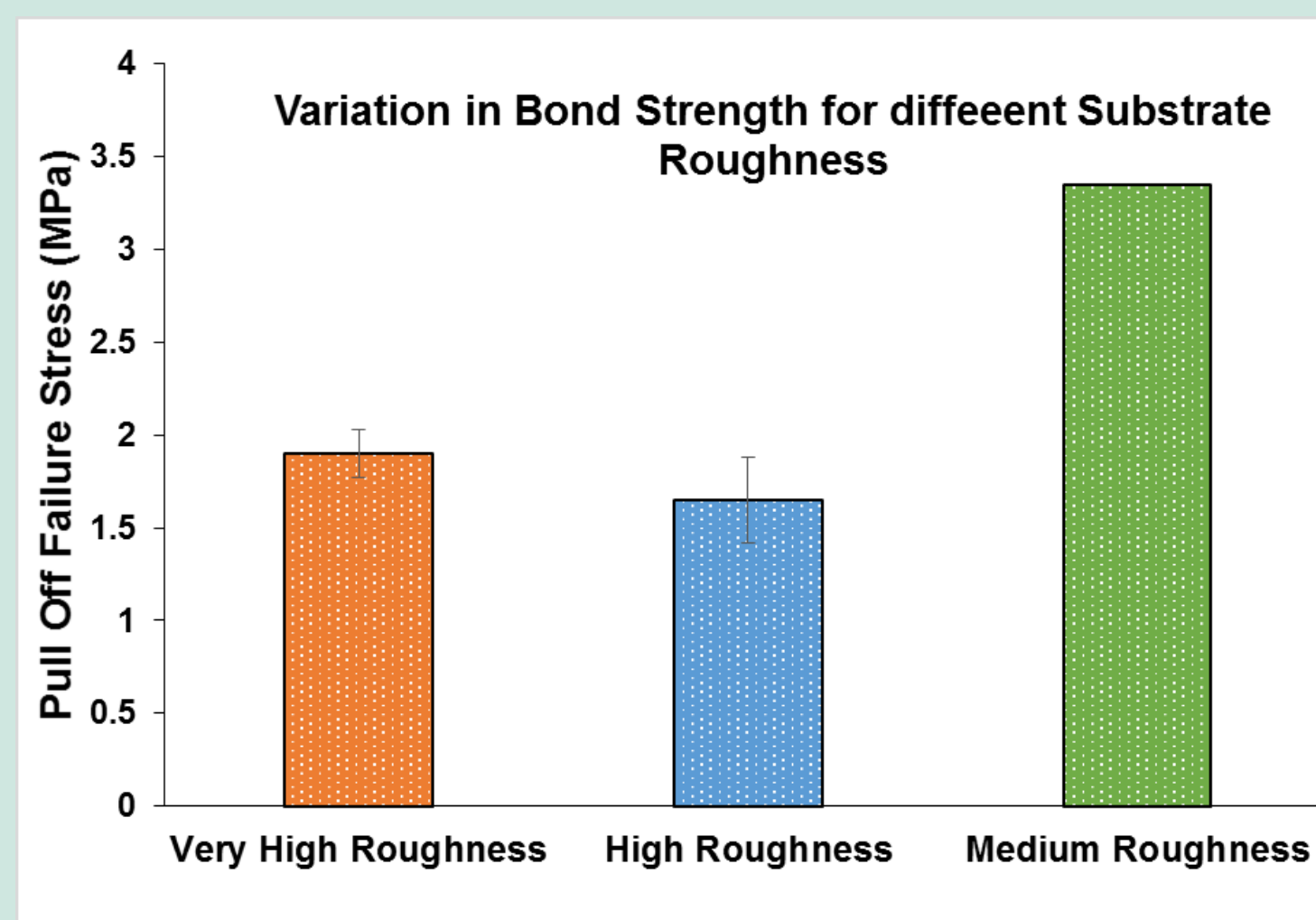
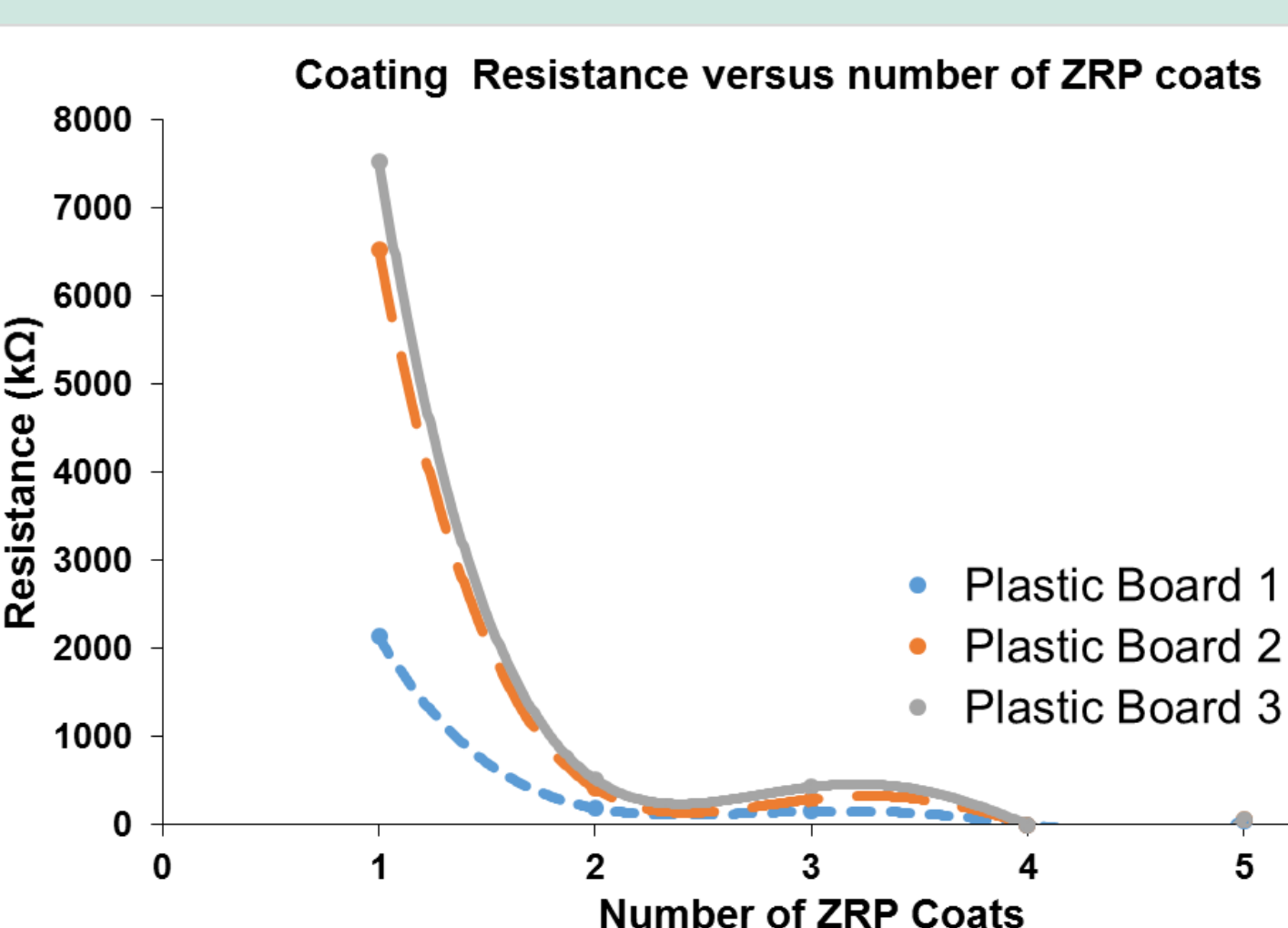
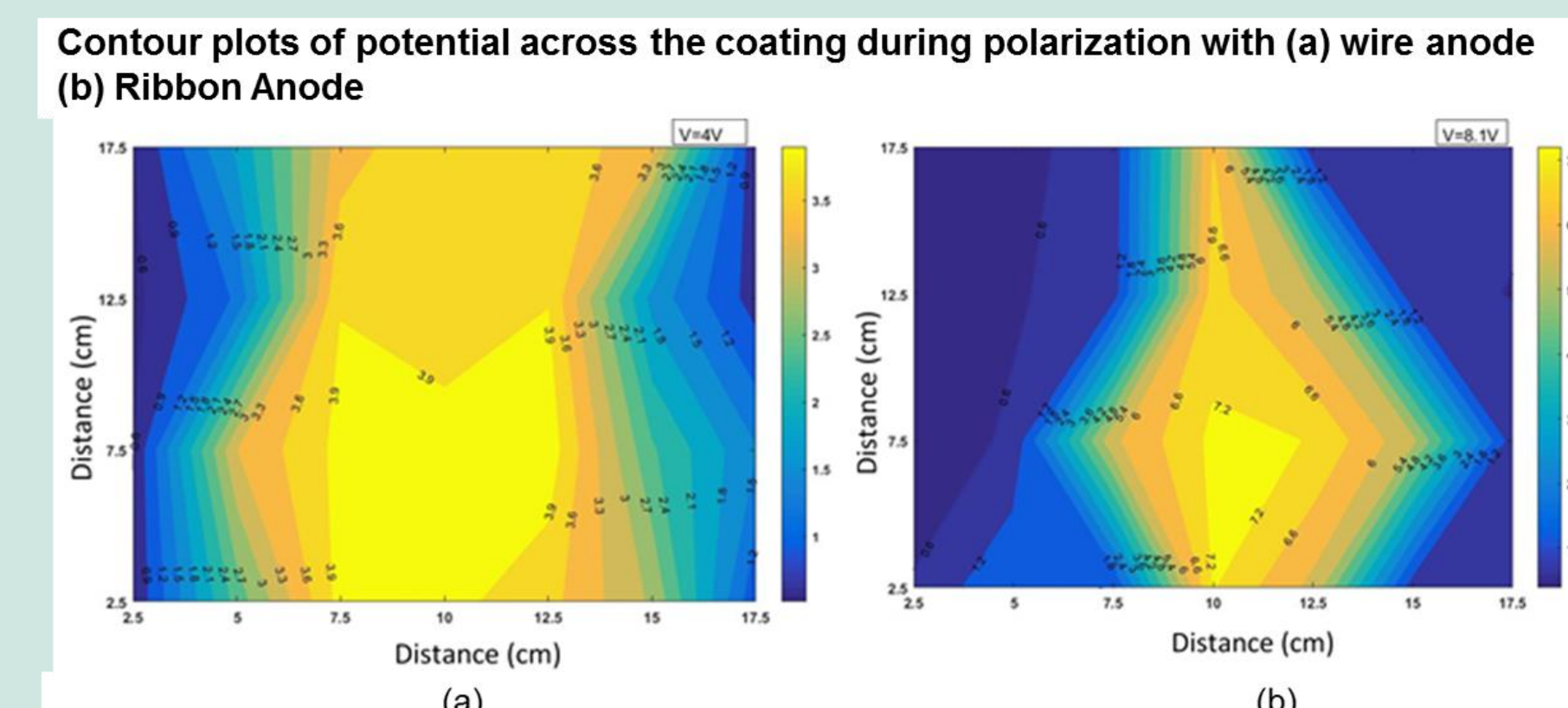
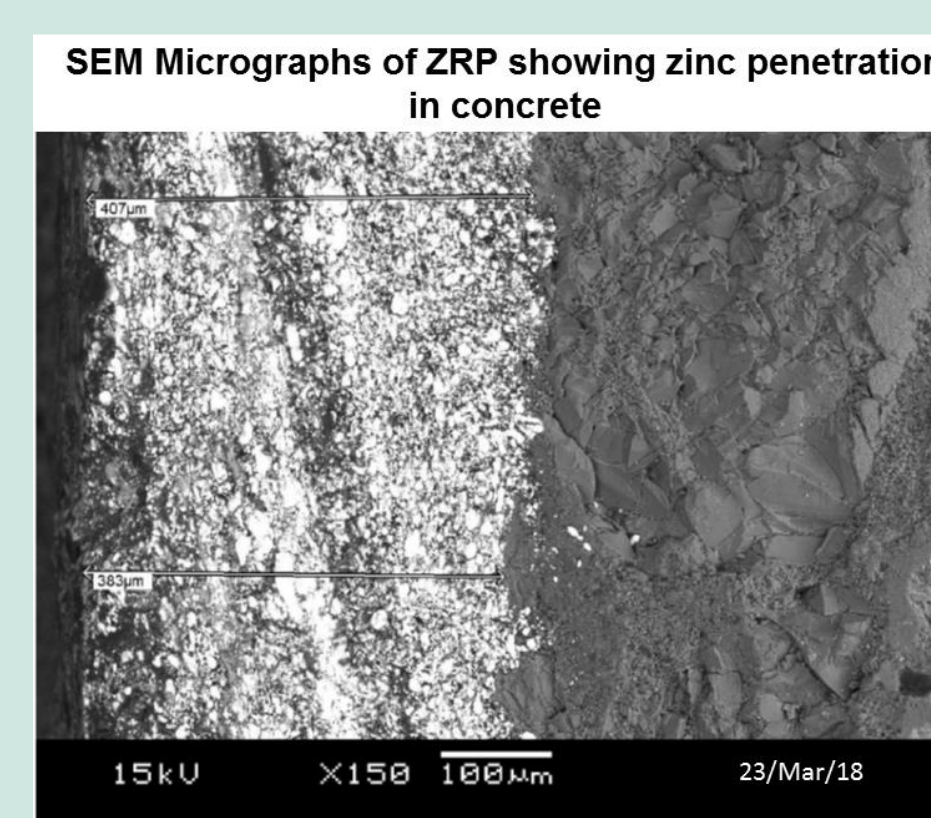
Wire Anode

Schematic of Polarization Test



### Results

- Maximum conductance and bond with 3 layers of ZRP on medium roughness concrete surface.
- Anomet Cu/Nb/Pt wire more suitable as primary anode conductor compared to MMO/Ti ribbon conductor.
- Polarization results showed satisfactory performance of the ZRP anode coating subjected to a current density of 12.50 mA/m<sup>2</sup> per anode surface area.



### Conclusion

ZRP conductive coating can be used successfully as an effective ICCP anode system and satisfy the performance criteria in accordance to NACE SP 0290<sup>5</sup> and BS EN 12696<sup>4</sup> standards

### References

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- BS EN ISO 12696; "Cathodic protection of steel in concrete", *British International Standard*, 2016.
- SP0290; "Impressed Current Cathodic Protection of Reinforcing Steel in Atmospherically Exposed Concrete Structures", NACE International, 2007.