Influence of Nicotine on the Tribocorrosion Behavior of Ti6Al4V Alloy in Artificial Saliva

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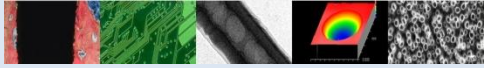


Background

- TI-6Al-4V is a widely accepted metal for dental implants due to its biocompatable and *osseointegrative* properties

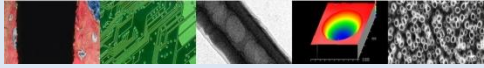
  Mavrogenis AF, et al., J. Musculoskelet Neuronal Interact, 2009

- Biomechanical forces and electrochemical attack from the surrounding environment can cause the implant to degrade, leading to implant rejection

  Yan Y, et al. Wear, 2007

- Clinical significance: released metal particles can lead to an adverse biological reaction resulting in local pain, swelling, and bone loss surrounding the implant

  Sharan D., Orthopaedic Update (India), 1999



Nicotine

- An estimated 46 million people (20.6% of all adults) aged 18 years and older in the United States smoke cigarettes

  CDS: Morbidity and Morality Weekly Report, 2010

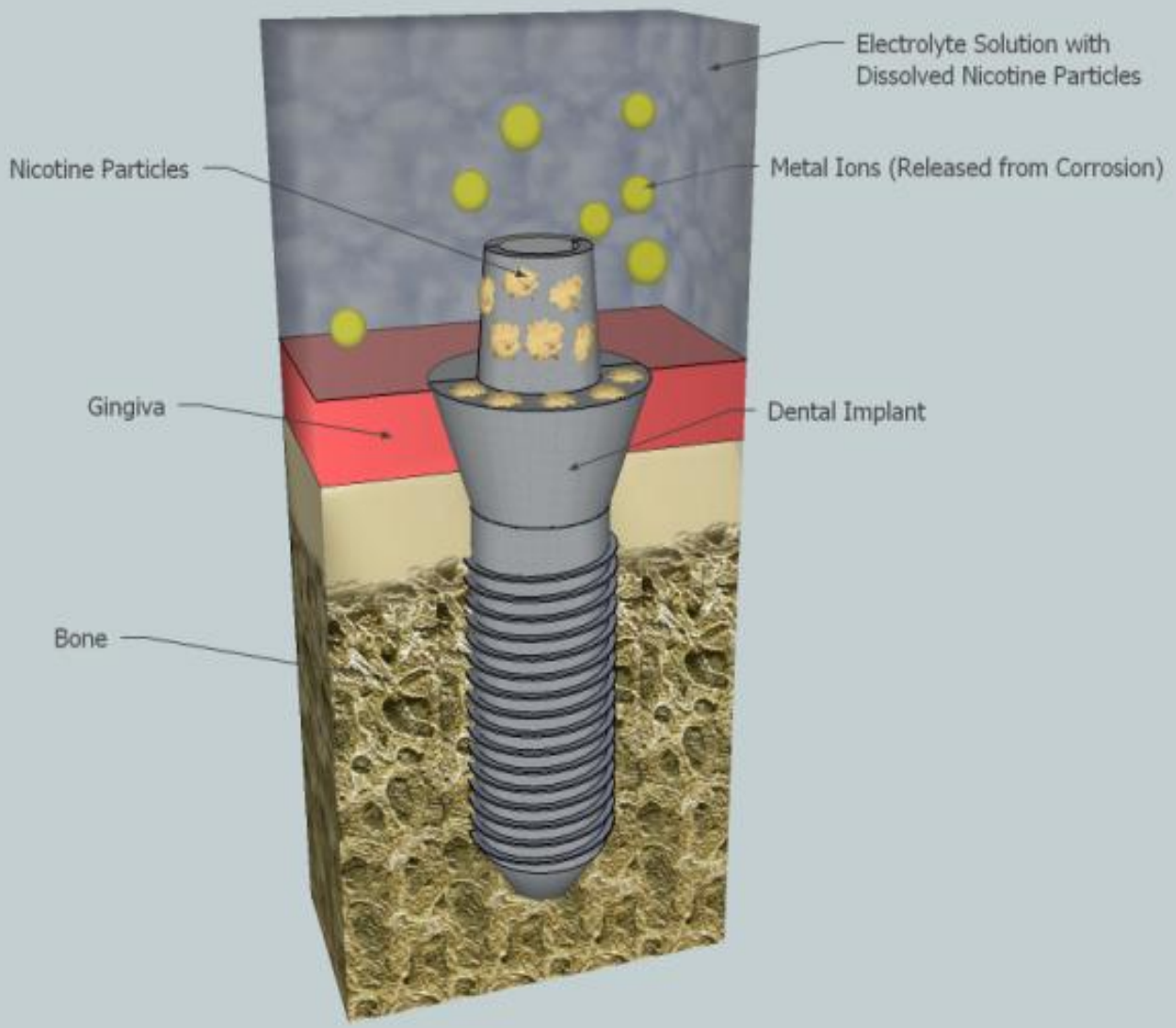
- Nicotine is a plant derived extract and a natural alkaloid

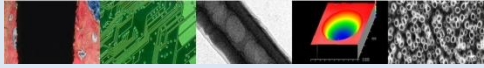
  Connolly GN et al., Tob Control, 2007

- Nicotine content in cigarettes has slowly increased over the years, and one study found that there was an average increase of 1.6% per year, from 1998 to 2005, in Machine-measured levels of smoke in cigarettes

  Connolly GN et al., Tob Control, 2007

Corrosive Environment





Motivation for the Study

- Smoking is known to increase implant failure rate

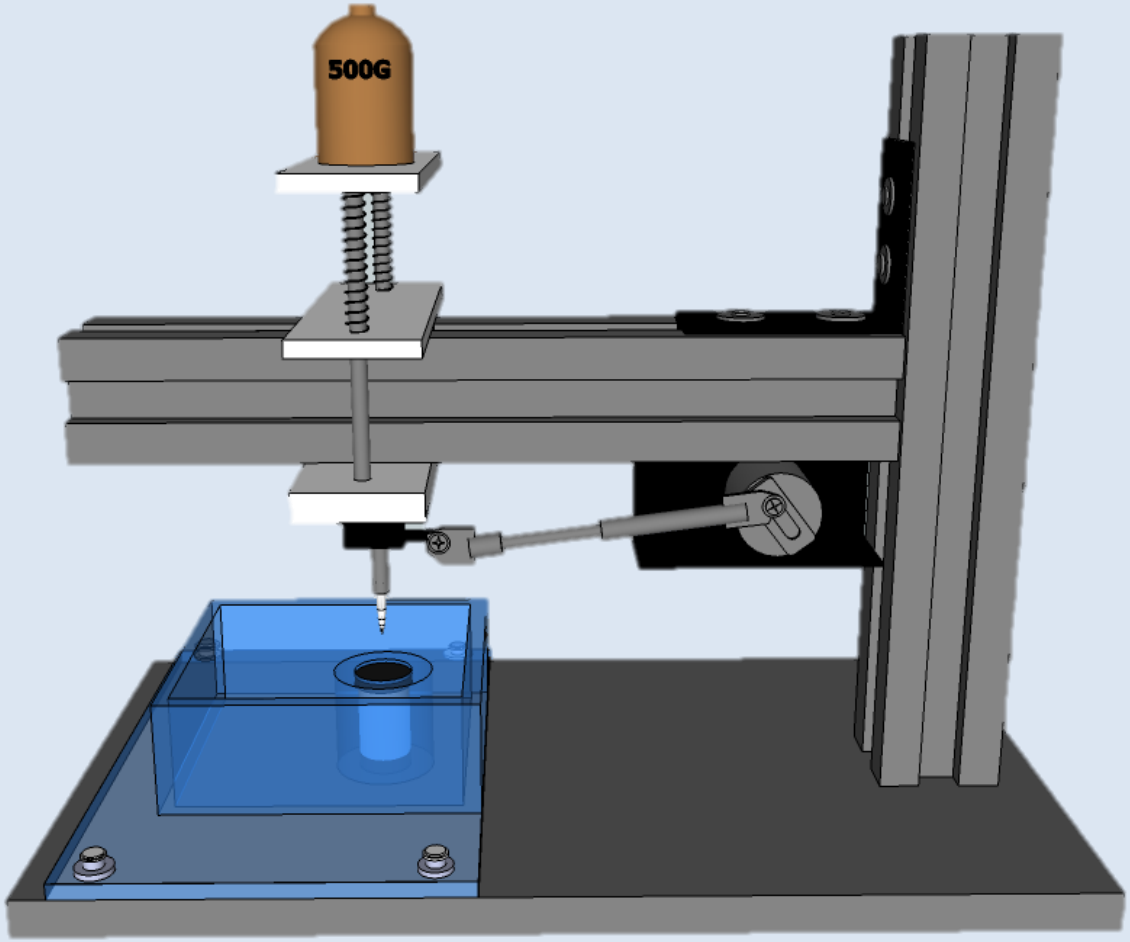
  Hinode D. Clinical oral implants research. 2006

- There is a limited amount of information available on the effect of nicotine's effect on the mechanical and chemical behavior of implants in simulated physiological conditions

- To investigate the corrosive behavior of TI6Al4V when exposed to artificial saliva in different pH levels and nicotine concentrations

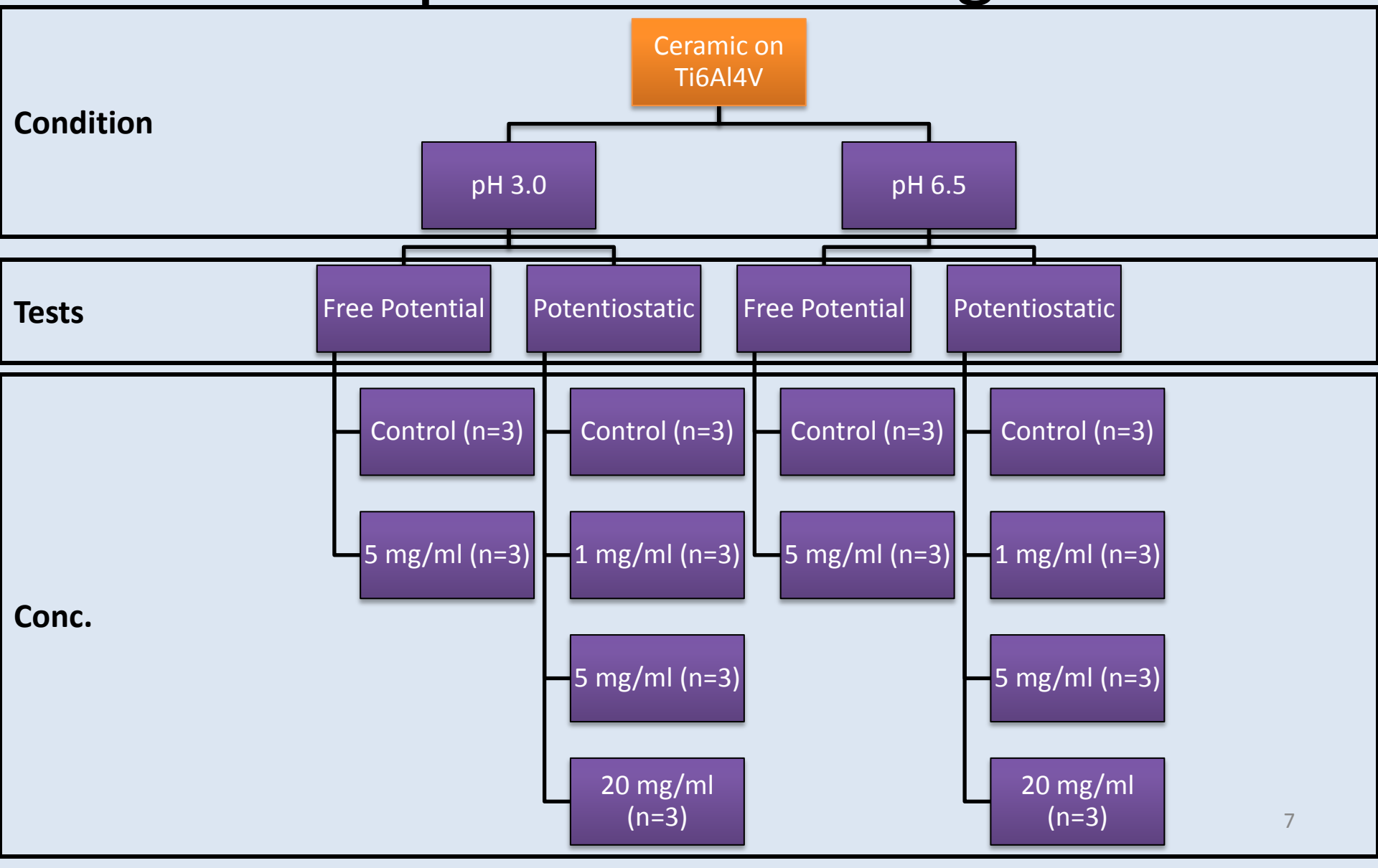
- **Hypothesis:** Increased nicotine concentration will increase the tribocorrosion behavior of TI6Al4V

Tribometer Setup



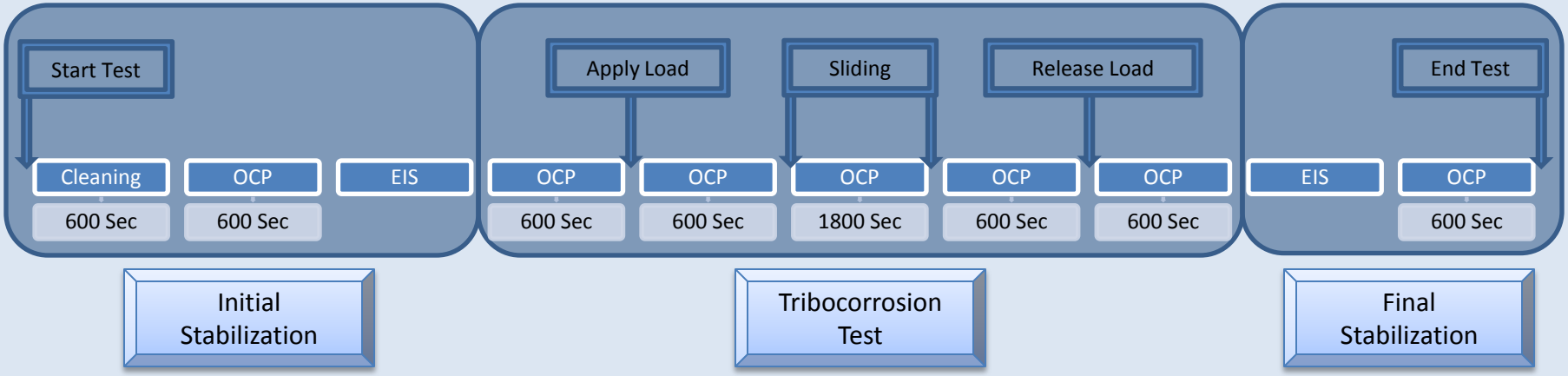
Art by Arman Butts

Experimental Design

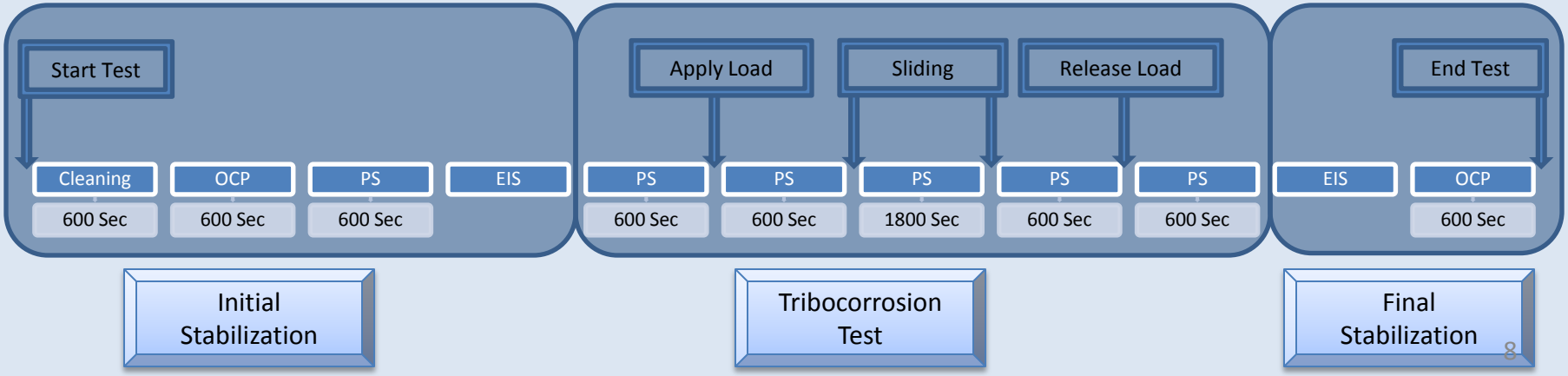


Experiment Protocol

Corrosion Potential Measurement (Free Potential)

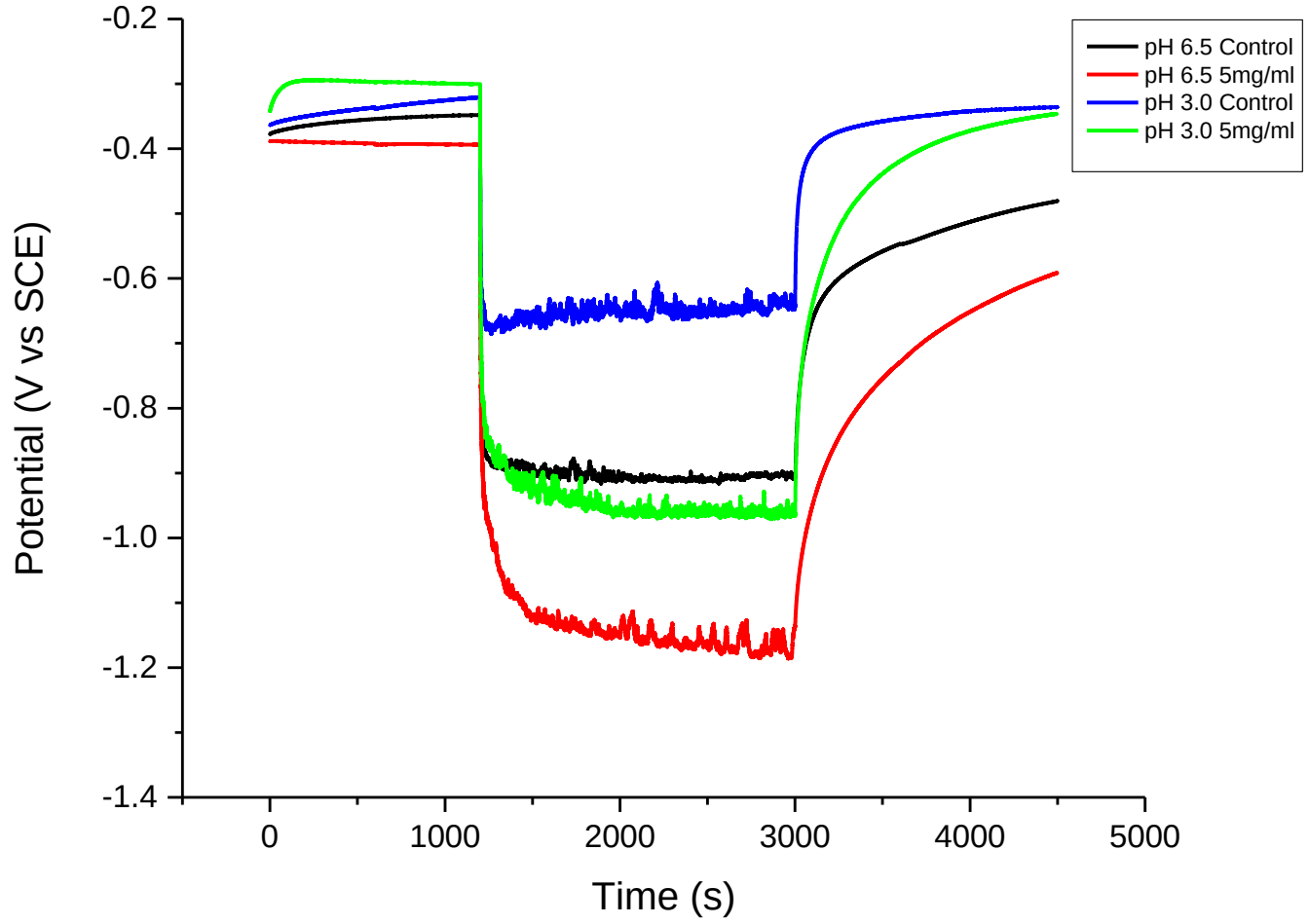


Potentiostatic Tests (Applying Potential)

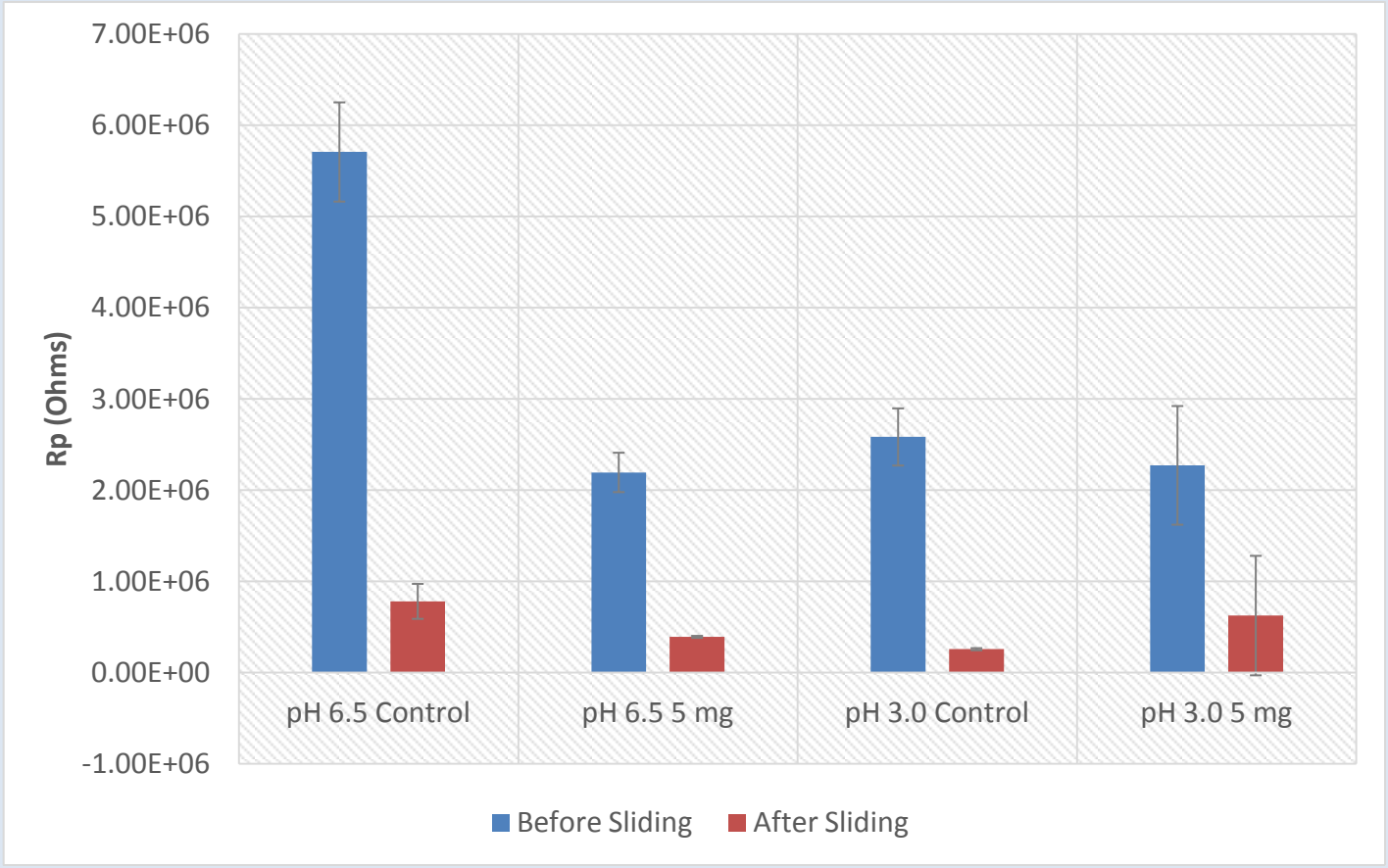


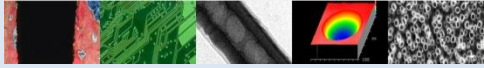
Free Potential Results

Free Potential Tests

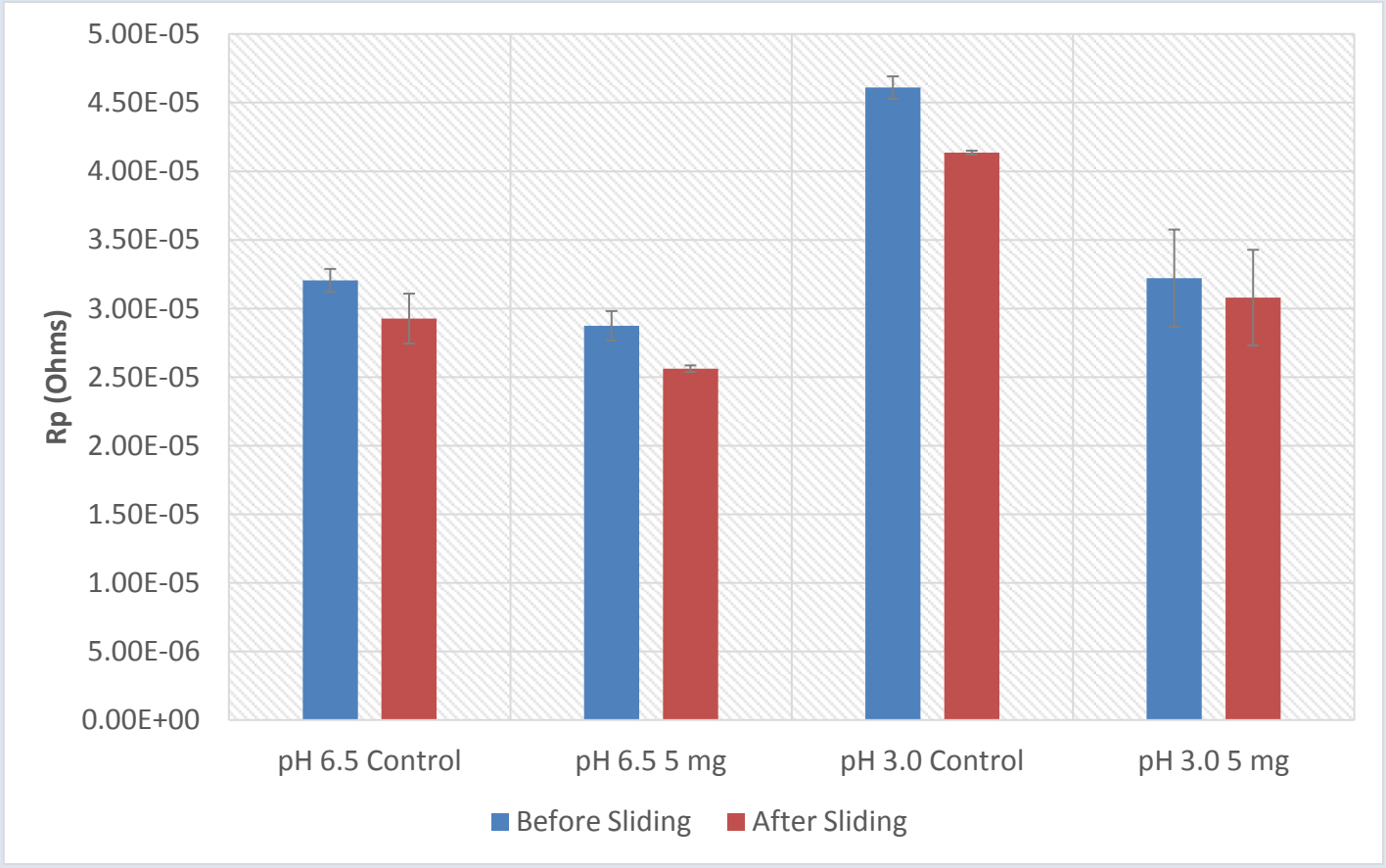


Resistance to Polarization

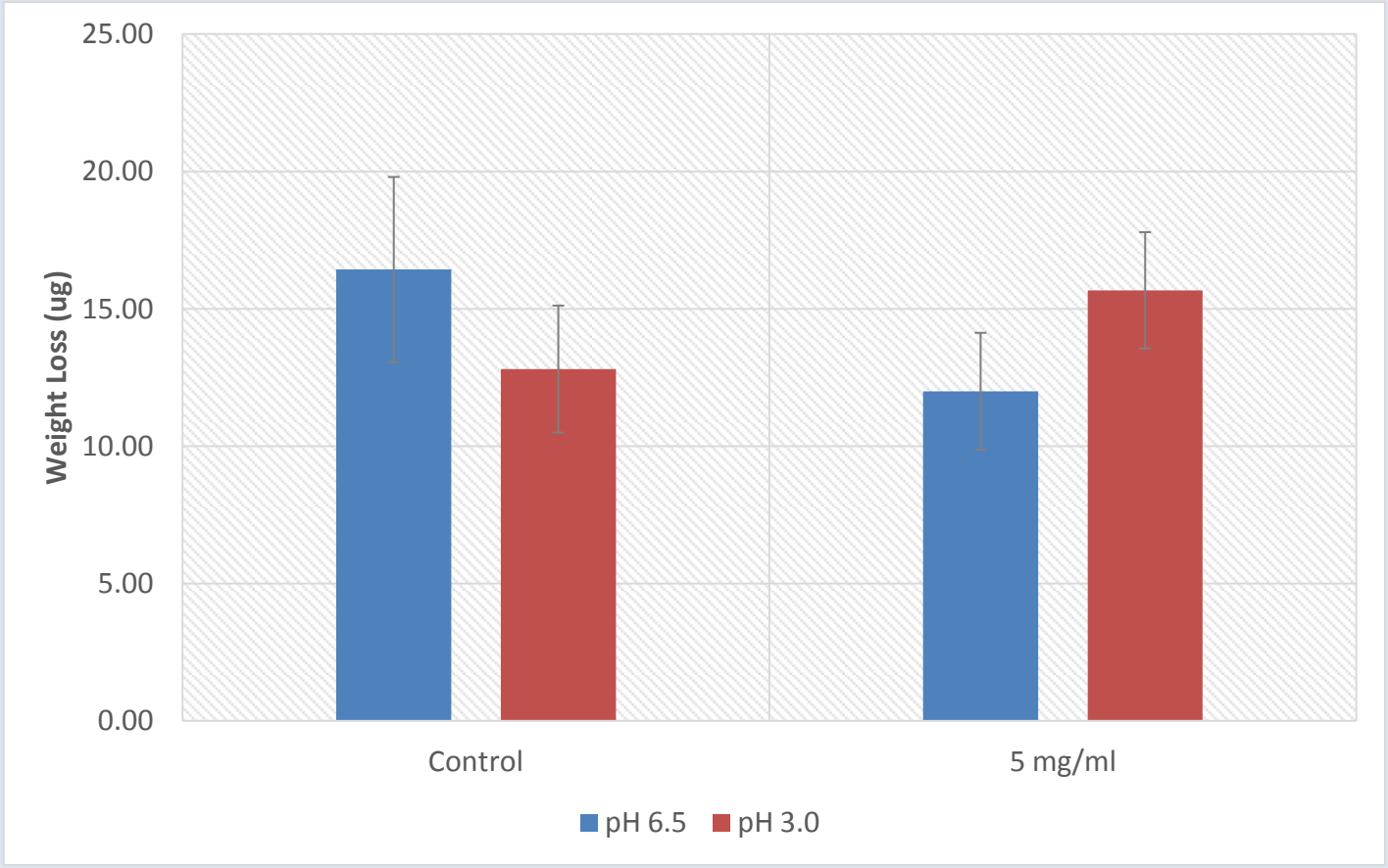




CPE

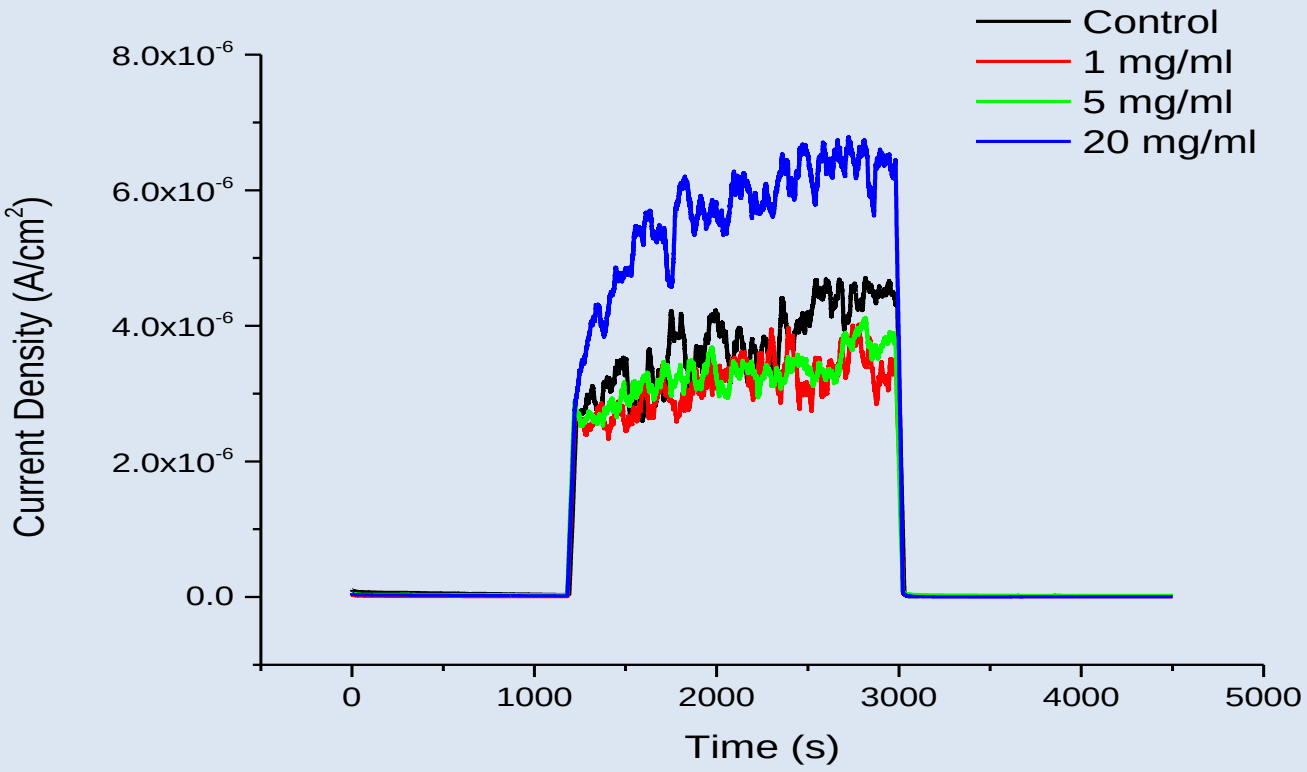

5.00E-05
4.50E-05
4.00E-05
3.50E-05
3.00E-05
2.50E-05
2.00E-05
1.50E-05
1.00E-05
5.00E-06
0.00E+00
Rp (Ohms)
pH 6.5 Control
pH 6.5 5 mg
pH 3.0 Control
pH 3.0 5 mg
Before Sliding
After Sliding

Free Potential Weight Loss

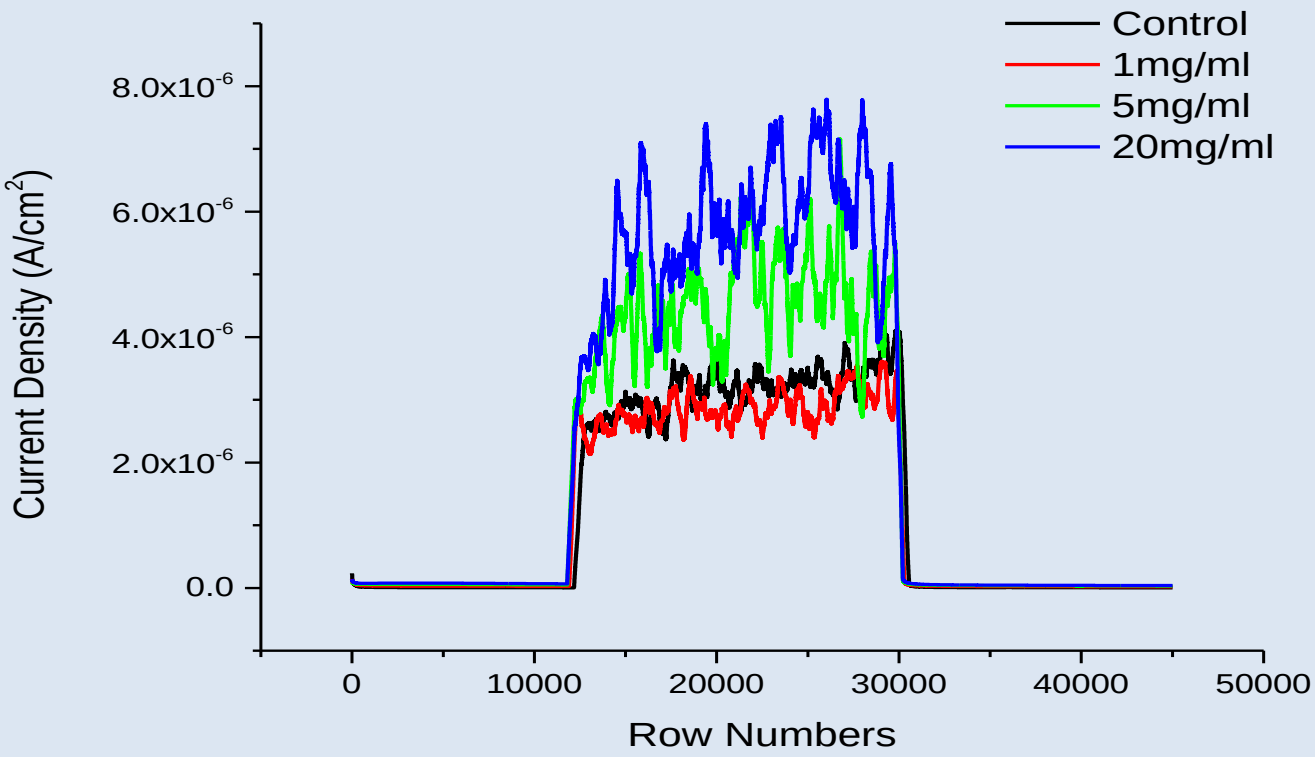


Potentiostatic Results

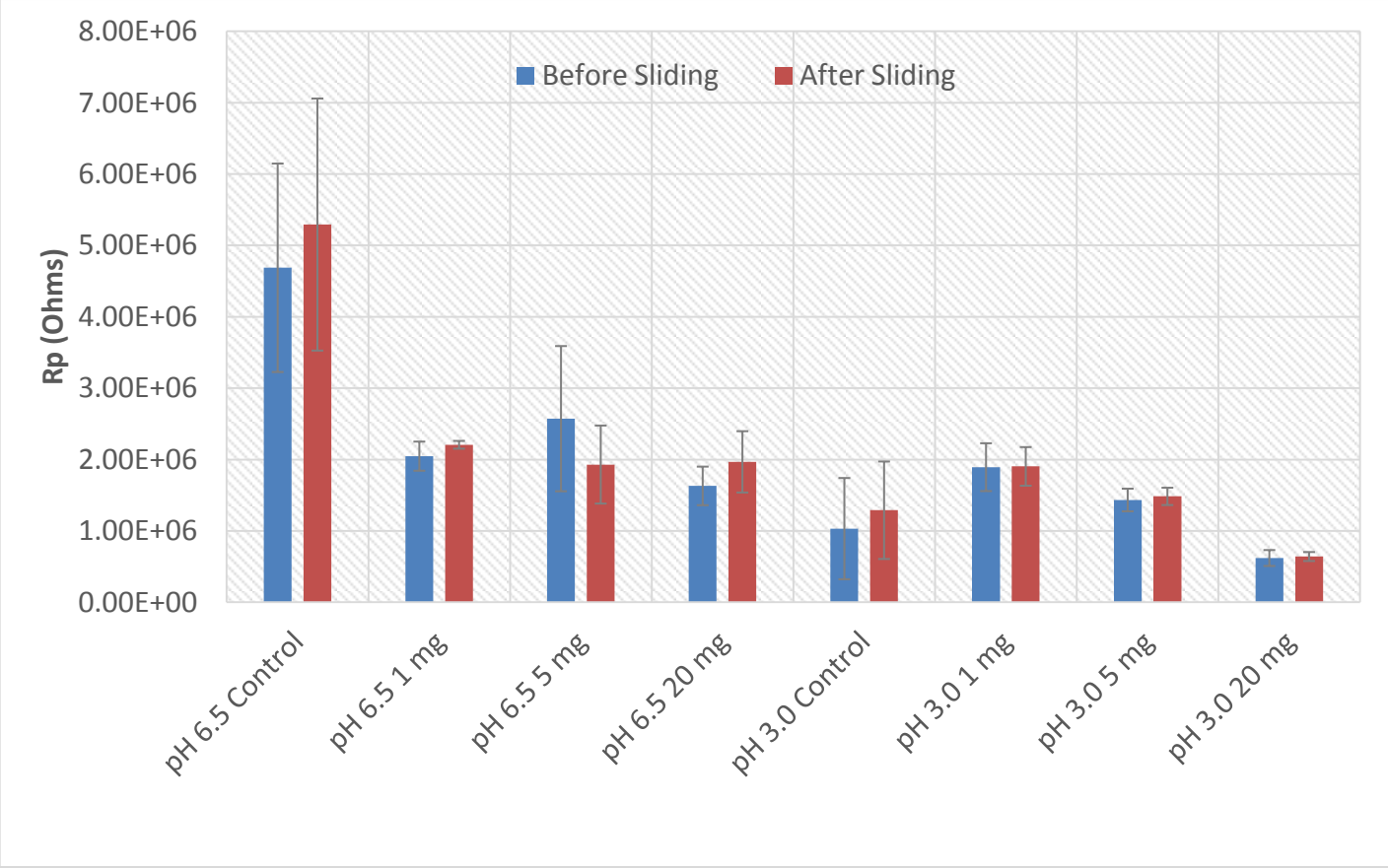
Potentiostatic pH 3.0



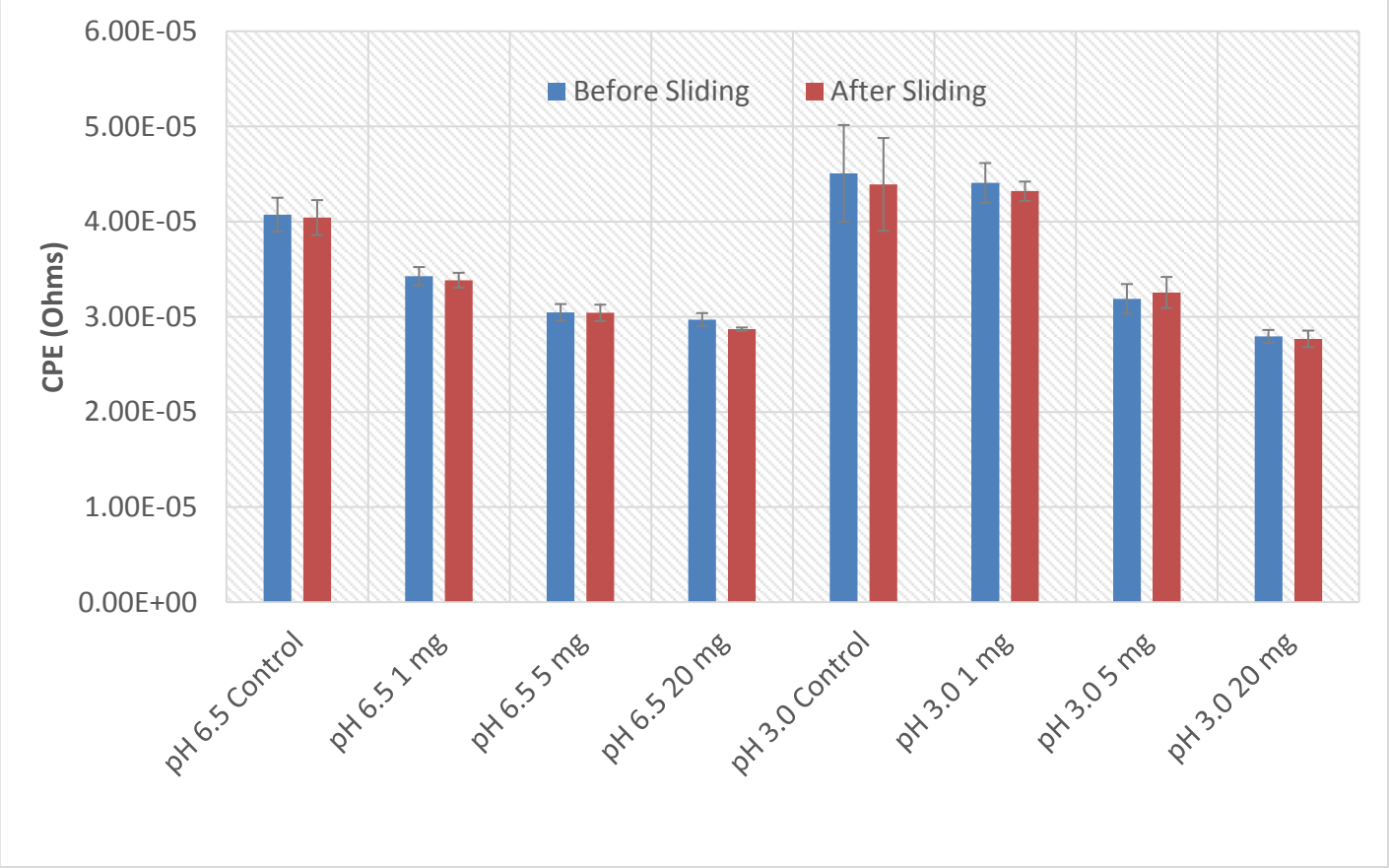
Potentiostatic pH 6.5



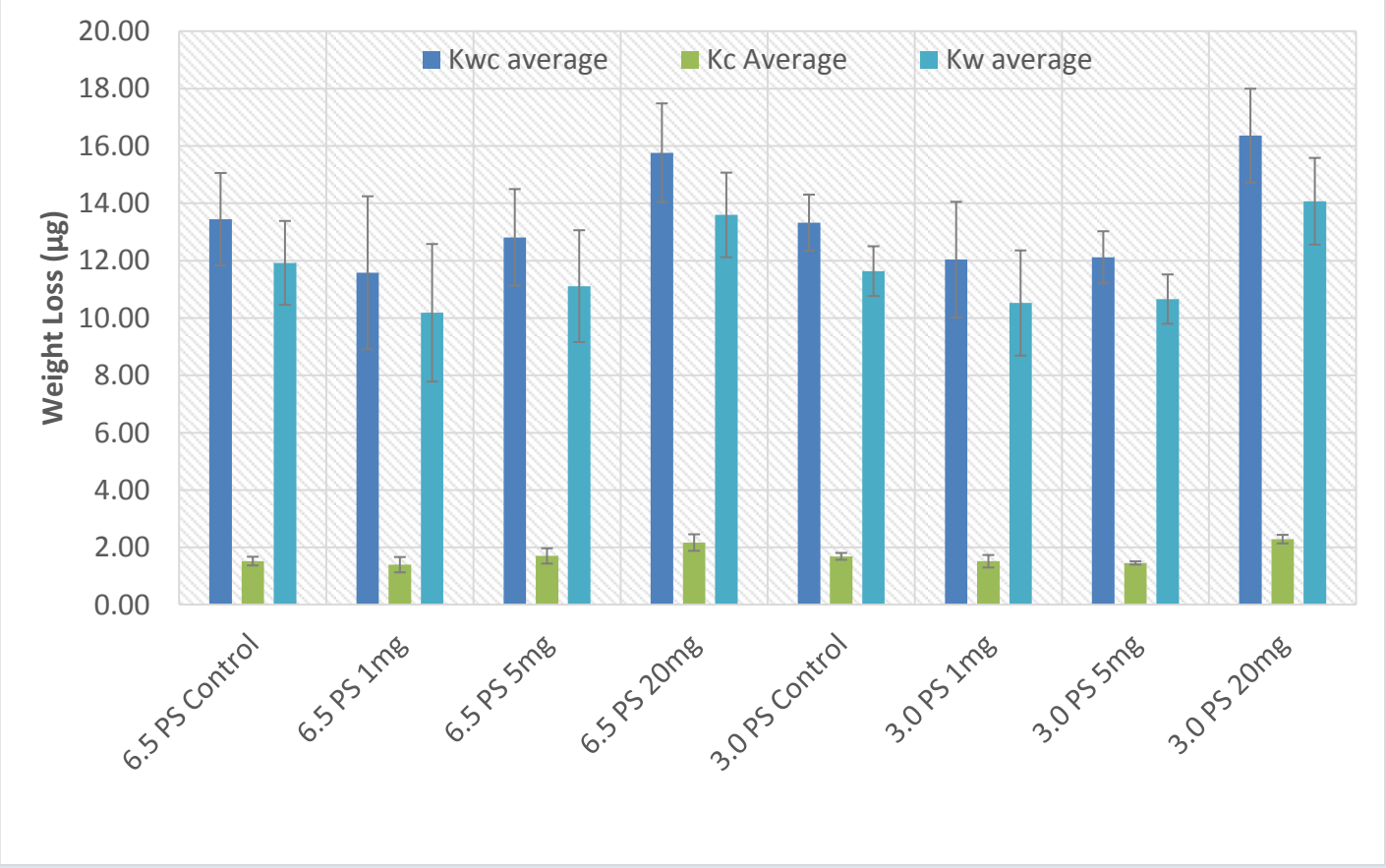
Resistance to Polarization

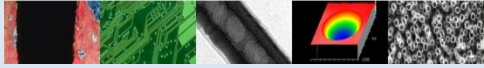


Capacitance



Weight Loss


Kwc average
Kc Average
Kw average
Weight Loss (µg)
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
6.5 PS Control
6.5 PS 1mg
6.5 PS 5mg
6.5 PS 20mg
3.0 PS Control
3.0 PS 1mg
3.0 PS 5mg
3.0 PS 20mg



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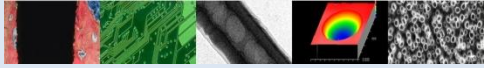

Thank You

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