

# Multifunctional Bioactive Coatings for Metallic Veterinary Implants

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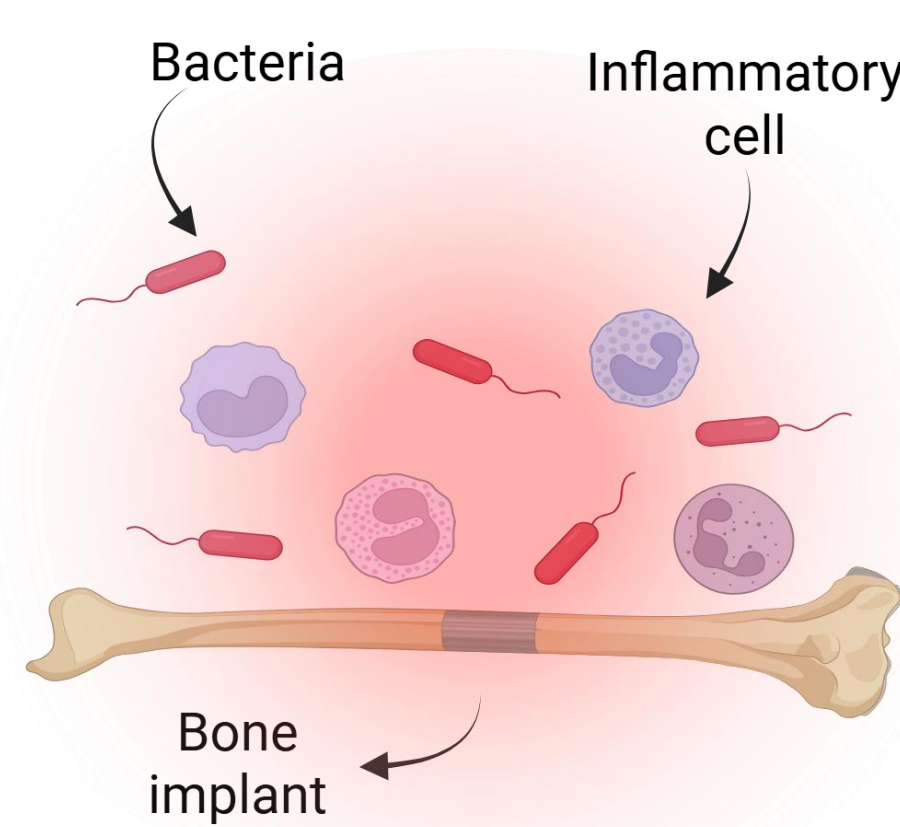
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## INTRODUCTION & AIM

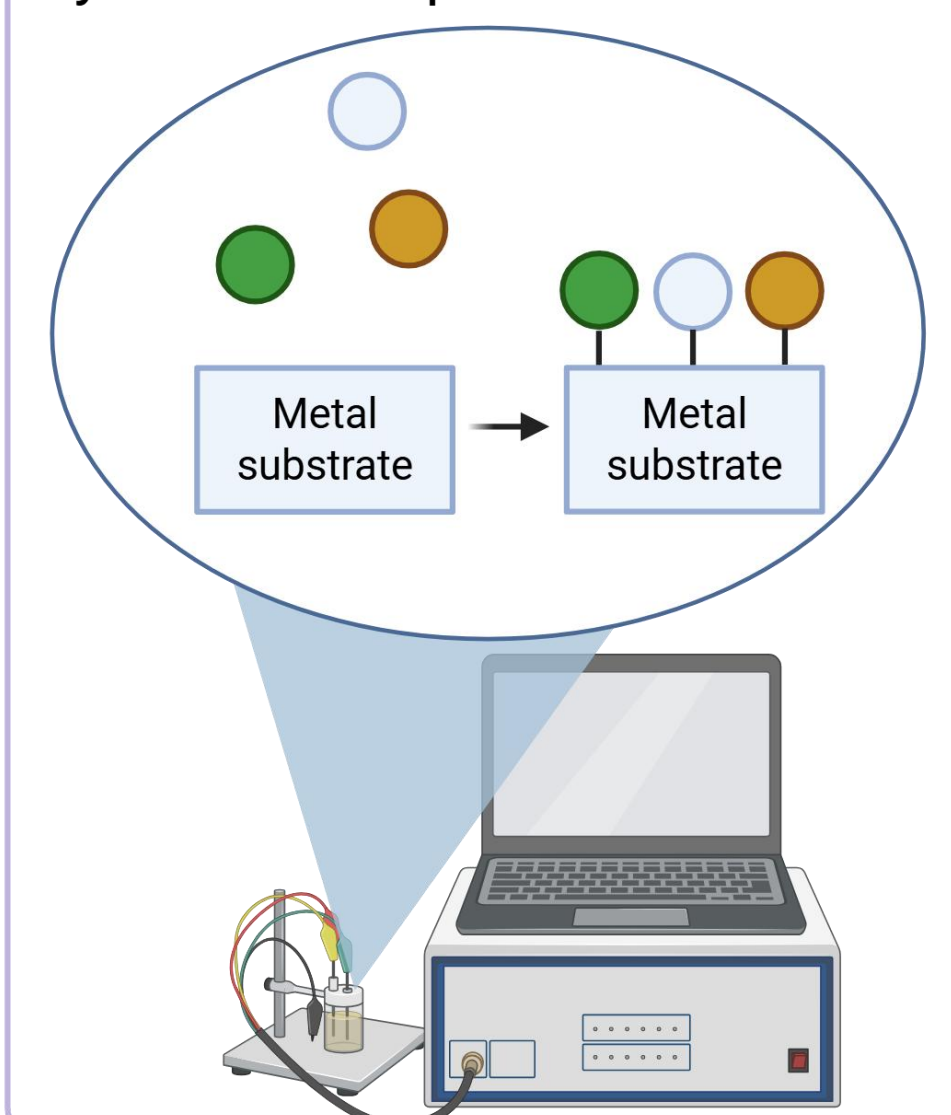
### Challenges

**Current Materials:** Metallic implants (Ti, 316L) offer excellent mechanical properties.  
**High Risk:** Vulnerability to bacterial infections, biocorrosion, and foreign-body responses.  
**Urgent Need:** Surface modifications to prevent bacterial adhesion and enhance biocompatibility.



### Methods

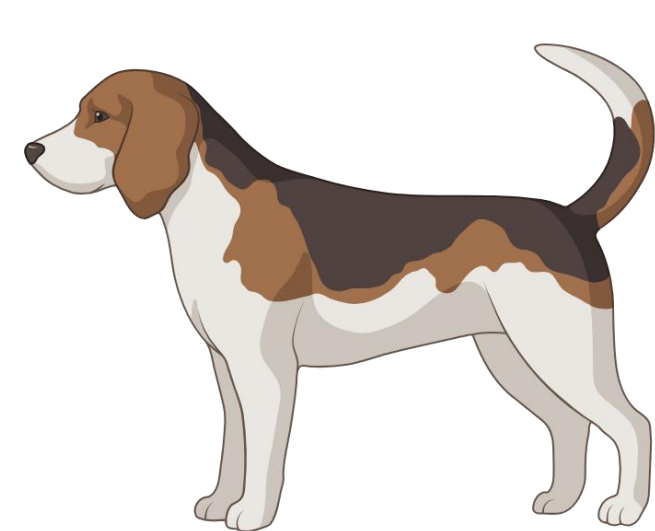
In this study, we propose an innovative electrochemical deposition of an "onium" salt mixture (diazonium, sulfonium, and iodonium) to create a protective, homogeneous organic layer on the implant surface.



### Key Outcomes and Potential

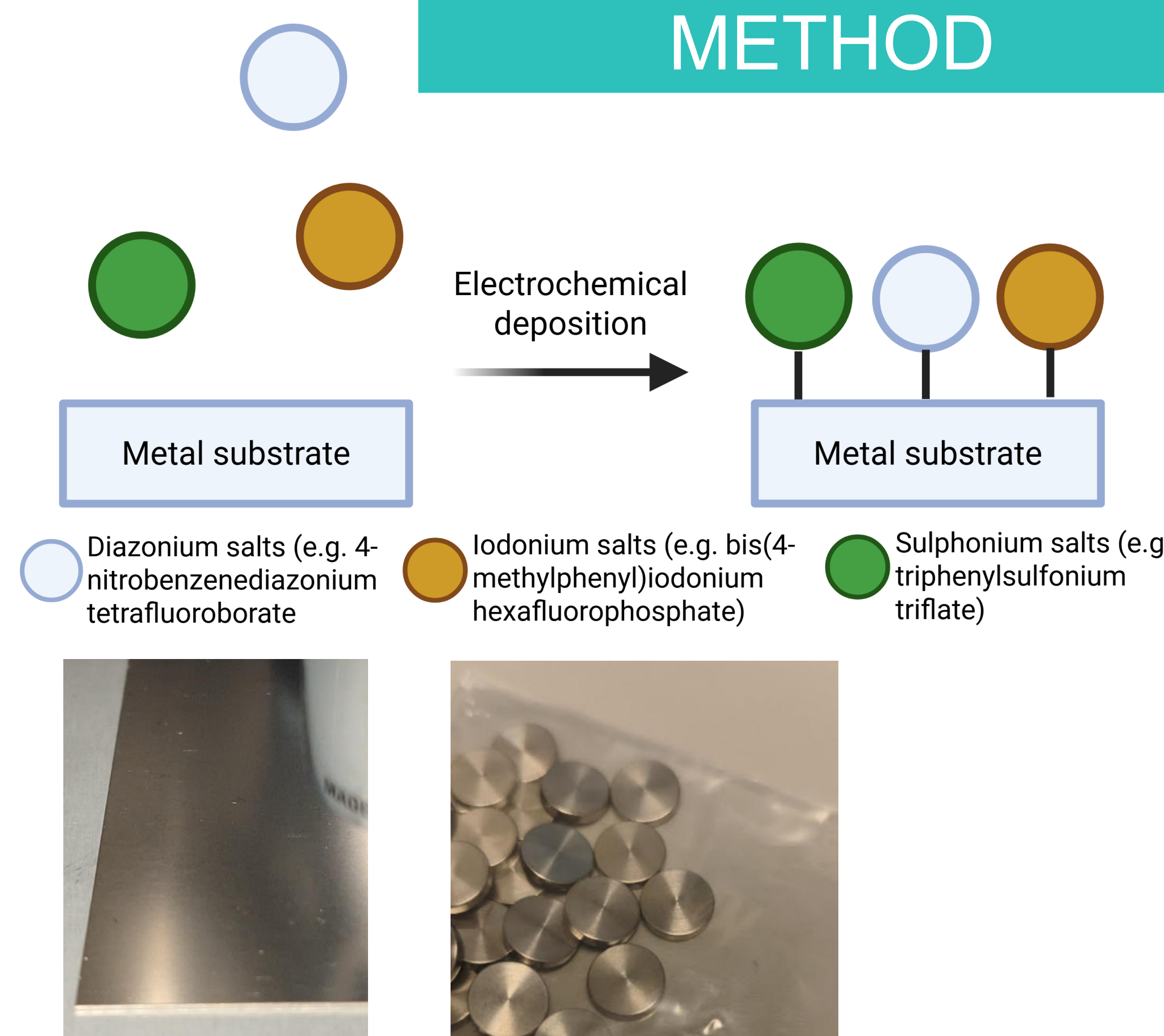
Bacterial resistance and improved biocompatibility

Enhanced corrosion resistance



Improved clinical success rate of veterinary implantations

## METHOD

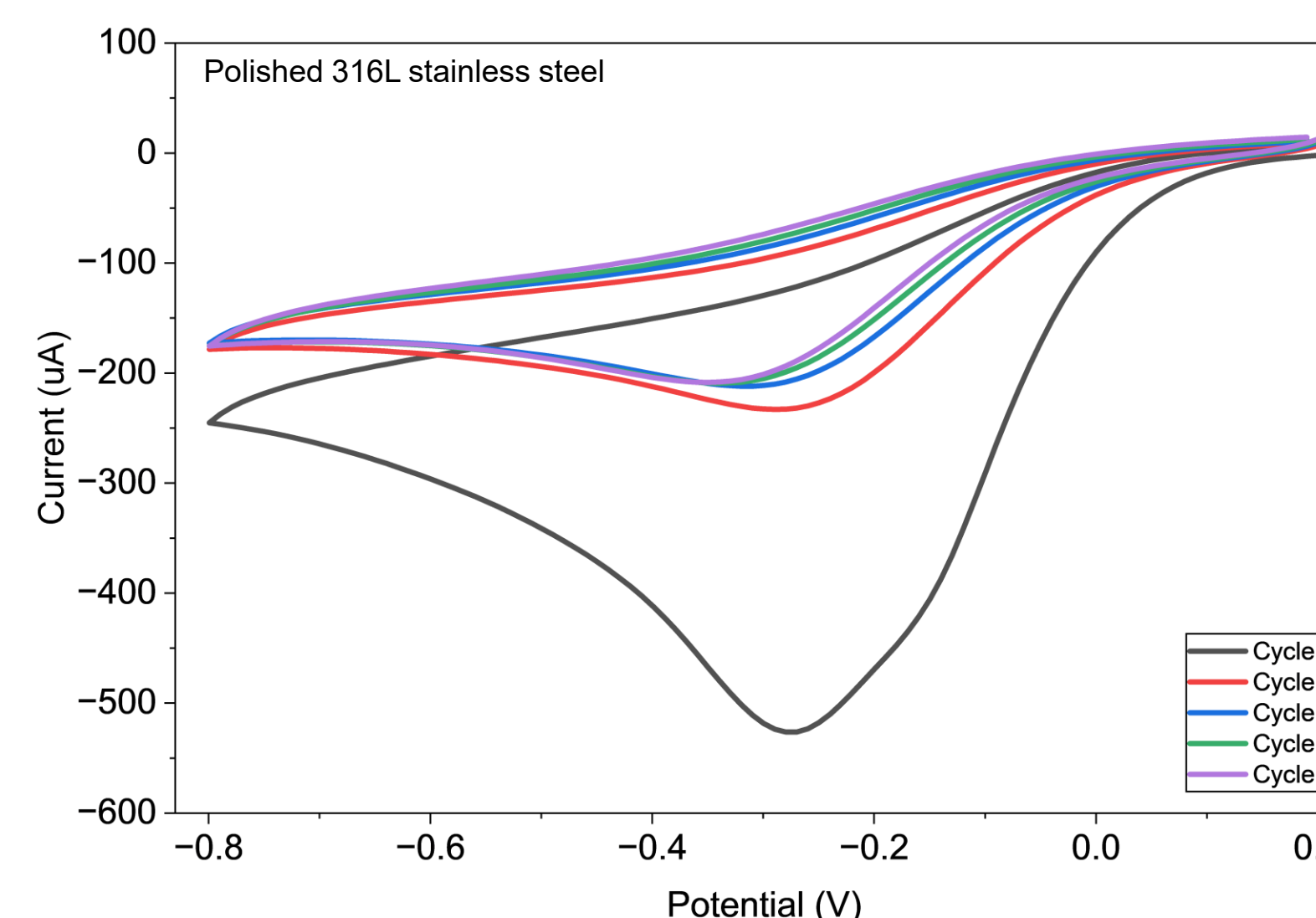
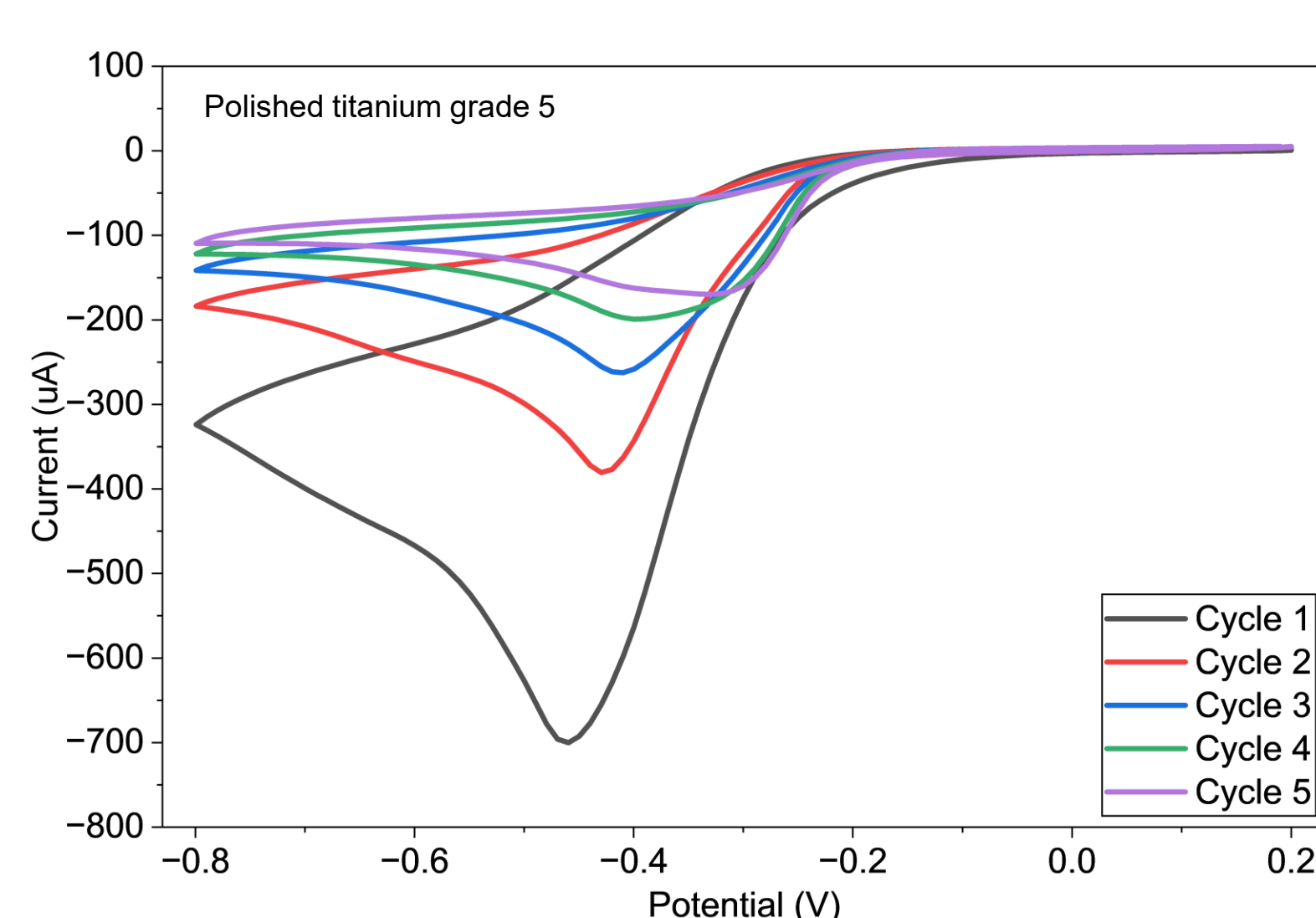
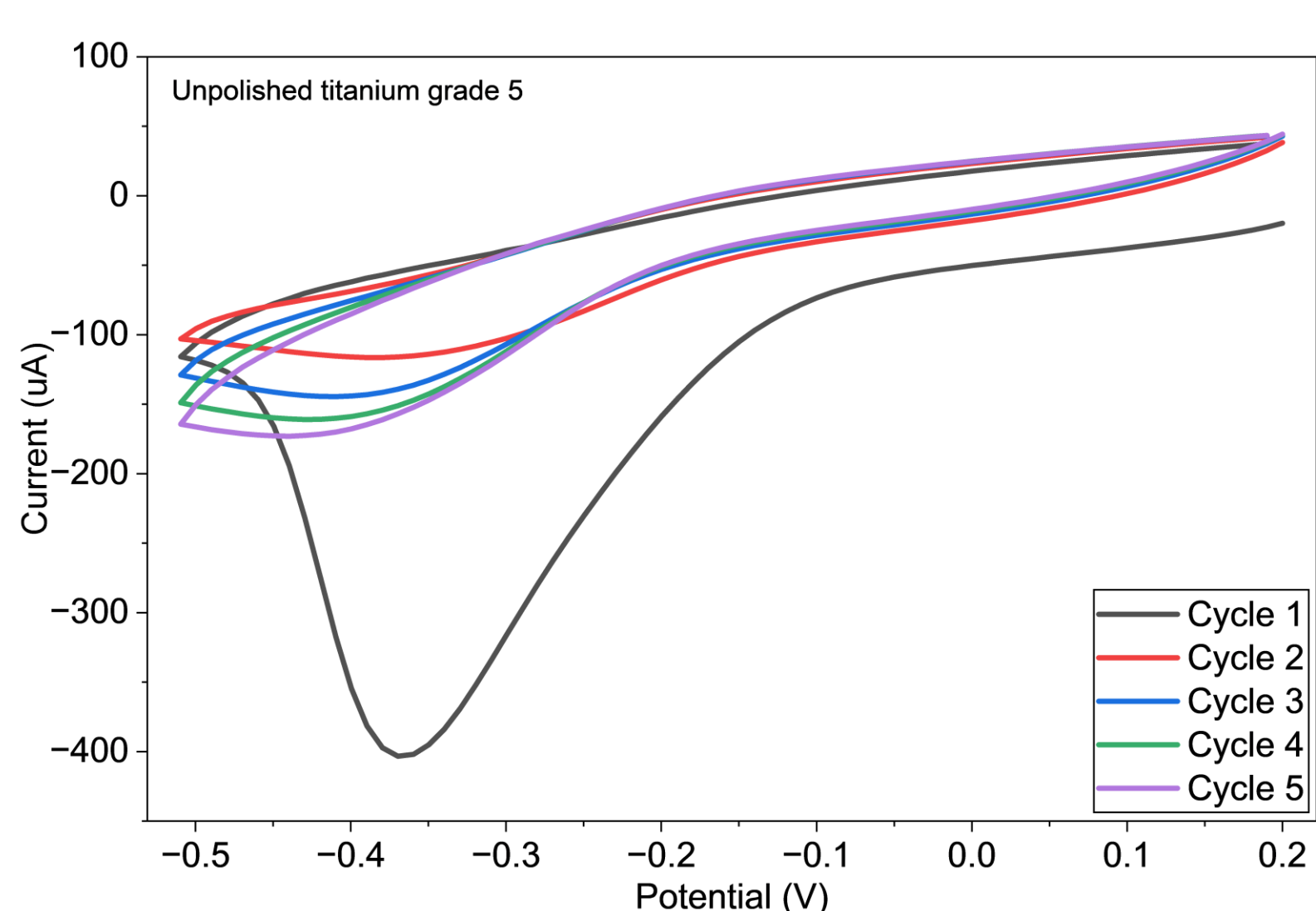


Stainless steel (316L), Titanium Grade 2 and Grade 5 are modified using Cyclic Voltammetry (CV) to graft organic layer on the metals surfaces. Later, surfaces are analysed using electrochemical techniques, i.e. Electrochemical Impedance Spectroscopy (EIS)

Prior to electrografting, the metal surfaces are polished using a grinder/polisher using 1000-grit sandpaper at 200 RPM. The surfaces are then placed in an ultrasonic cleaner for 10 minutes in a Tergazyme solution to remove any contaminants.

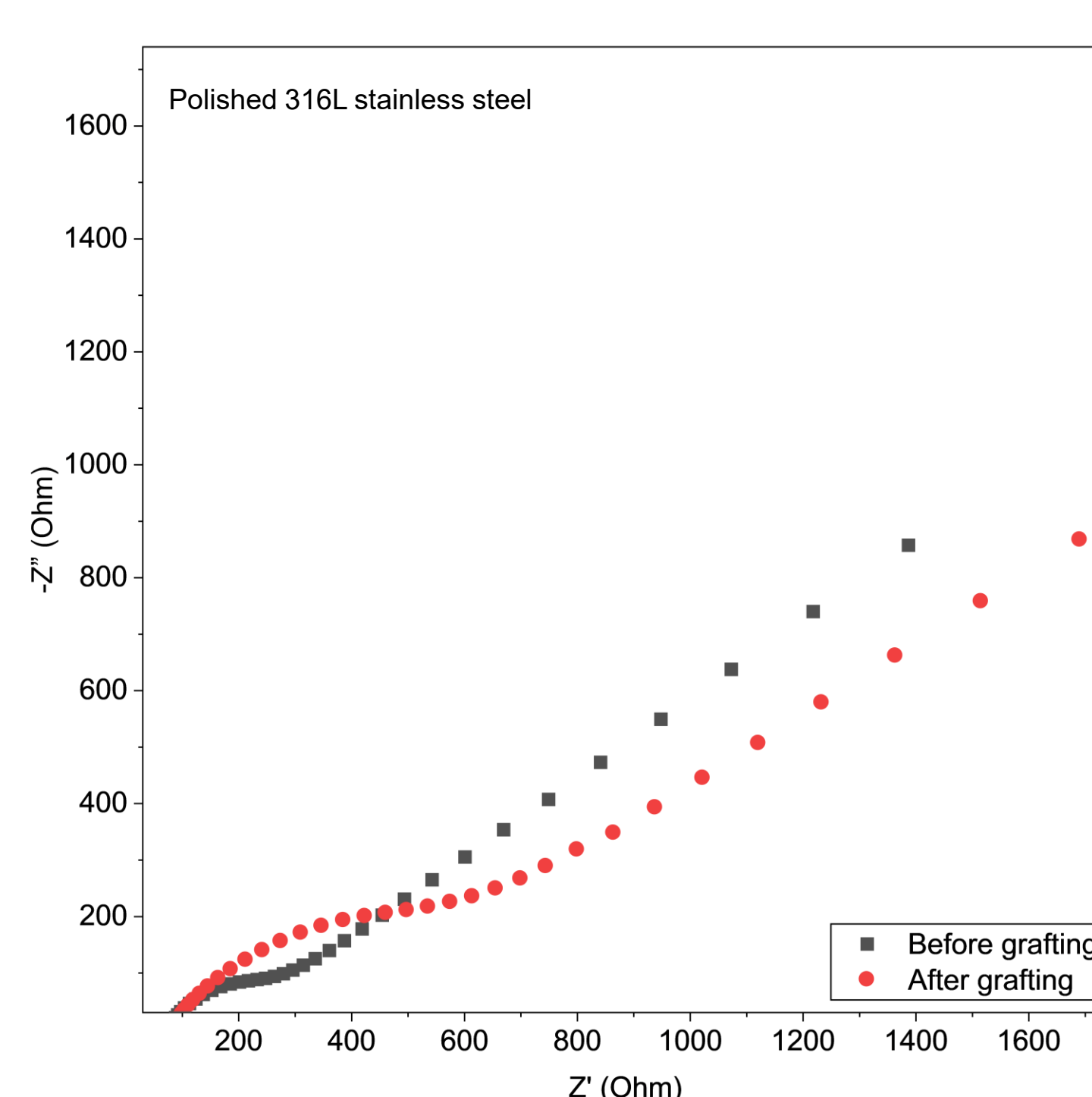
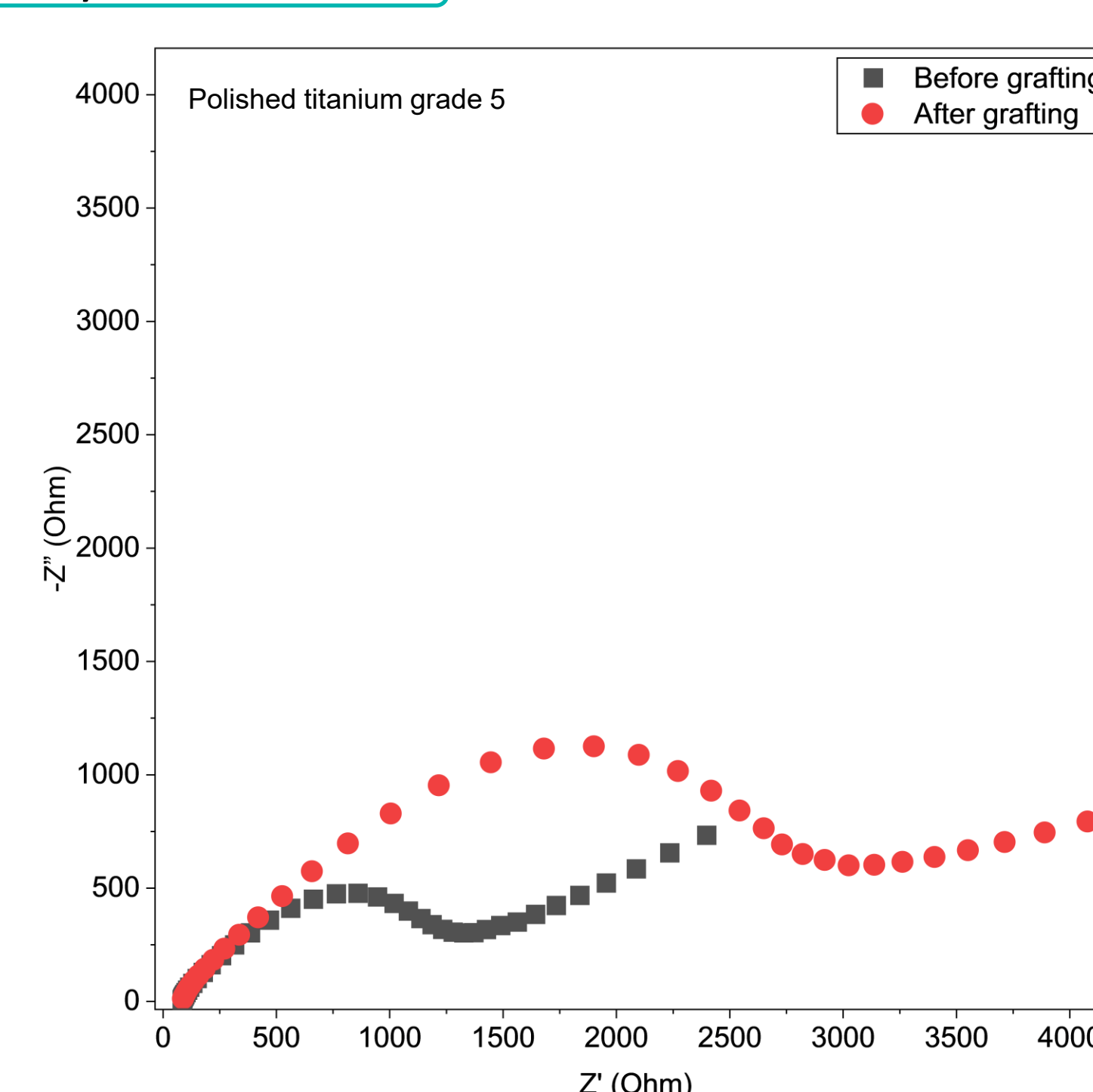
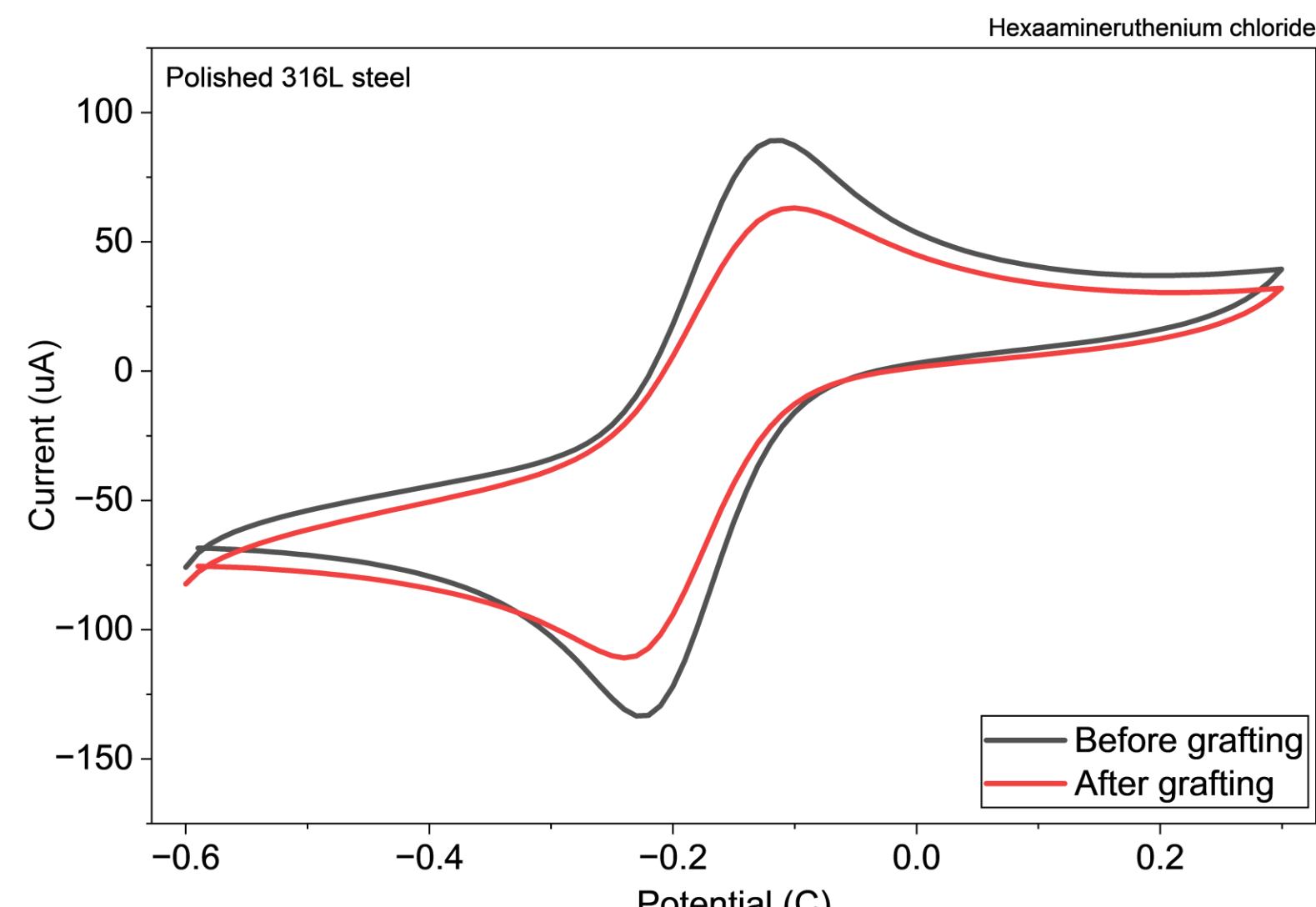
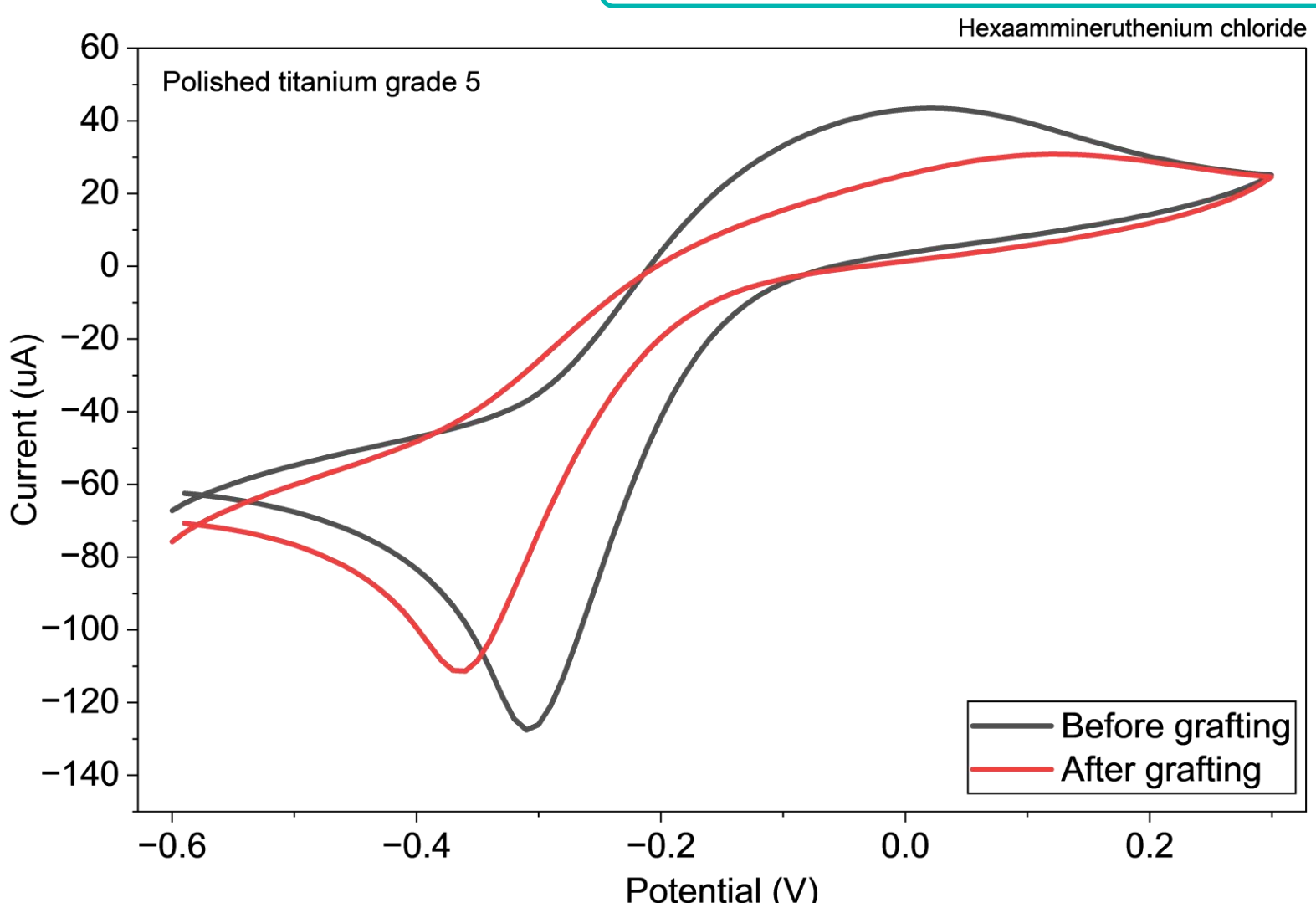
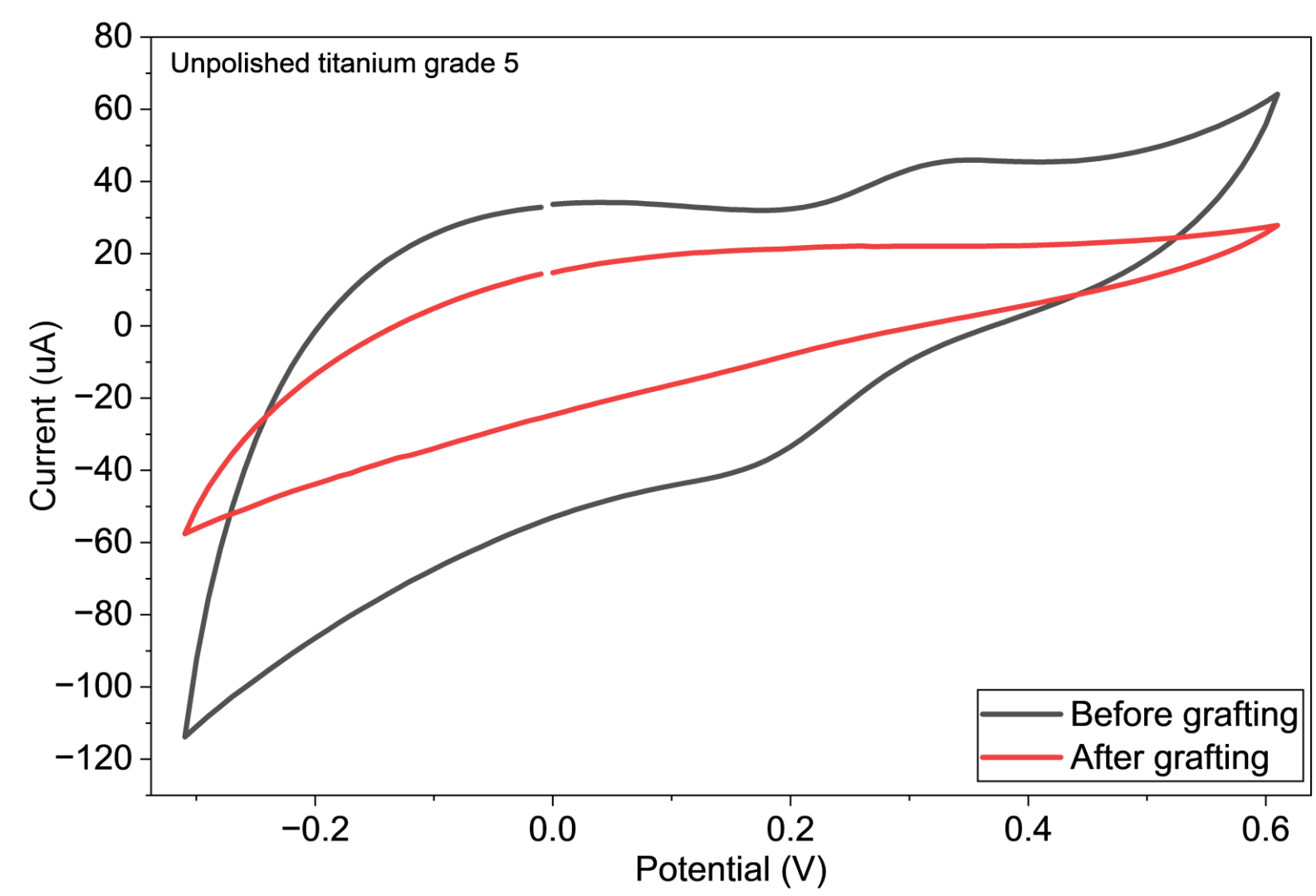
## RESULTS & DISCUSSION

### Grafting of 4-nitrobenzenediazonium salt



The 4-nitrobenzenediazonium tetrafluoroborate (10 mM) was dissolved in acetonitrile with 0.1 M of tetrabutylammonium tetrafluoroborate. Such solution was used for electrografting on different surfaces – unpolished and polished stainless steel and titanium grade 5.

### Electrochemical analysis



Electrochemical analysis was performed using redox mediators potassium ferrocyanide (unpolished grade 5 titanium) and hexaaminoruthenium chloride (polished grade 5 titanium and 316L steel). The redox responses of these mediators were collected before and after diazonium salt grafting and compared. Electrochemical impedance spectroscopy measurements were also performed for polished grade 5 titanium and stainless steel at a potential of -0.2 V over a frequency range of 10 kHz to 0.1 Hz.

## CONCLUSIONS

**Surface Preparation is Crucial:** Unpolished 316L stainless steel prevents organic layer deposition due to high resistance from native oxides and extensive machining topography. While grade 5 titanium allows for partial reduction without polishing, its native resistance remains significant.

**Successful Electrografting:** Mechanical polishing significantly improves the electrochemical response of both metals. The successful formation of a diazonium layer on polished surfaces is confirmed by the disappearance of the reduction peak in consecutive CV cycles.

**Barrier Properties Confirmed:** The presence of the grafted organic layer effectively blocks the surface, evidenced by a significant decrease in redox peak currents and a marked increase in charge transfer resistance in EIS measurements.

## FUTURE WORK/ REFERENCES/ACKNOWLEDGMENT

Work to date has focused on optimizing electrode preparation processes for electrochemical measurements. Next, the procedure for reducing selected iodonium, sulfonium, and diazonium salts on the electrode surfaces will be optimized, and their impact on key parameters such as wettability, cell adhesion, biocompatibility, and antibacterial activity will be assessed.

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