

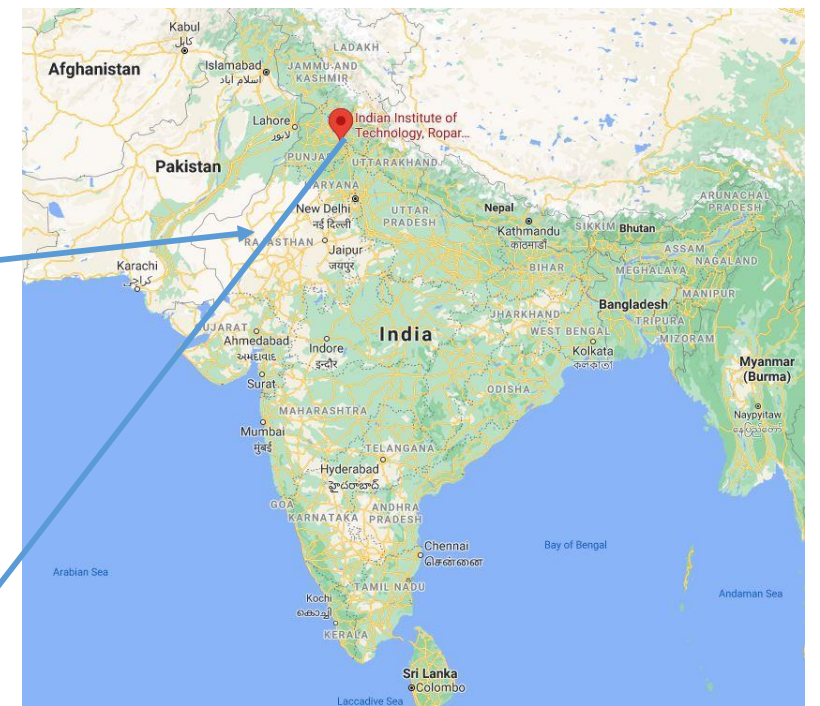
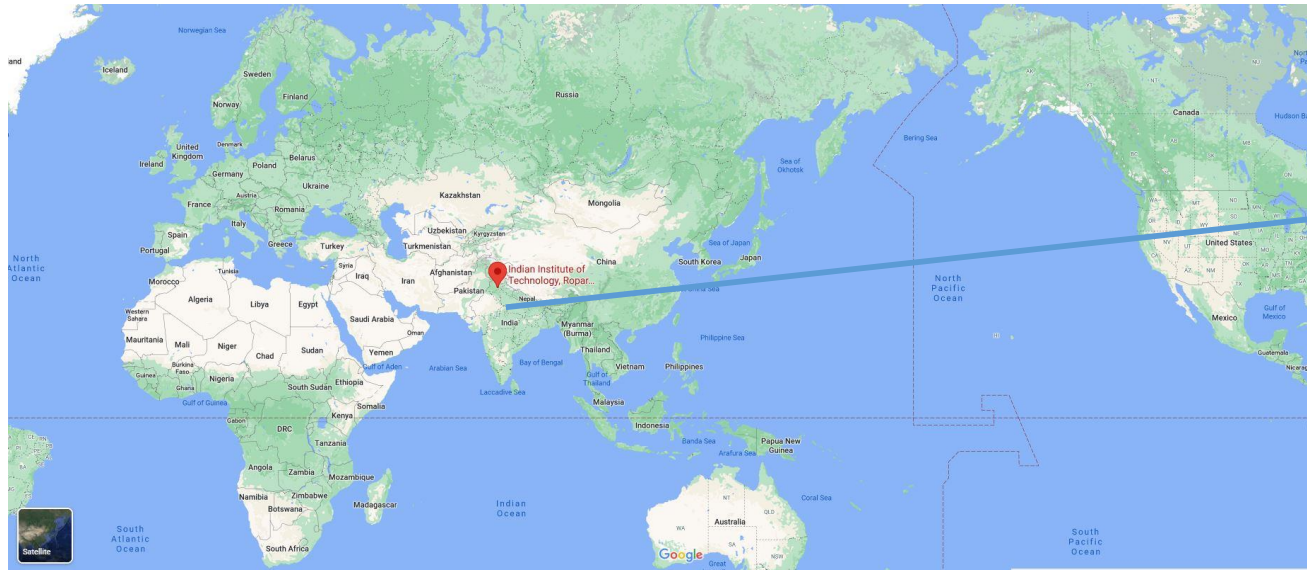
Development of Cold-Sprayed Titanium/Baghdadite Composite Coating for Bio-implant Applications*



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* The work is under consideration in Journal of Thermal Spray Technology for publication.

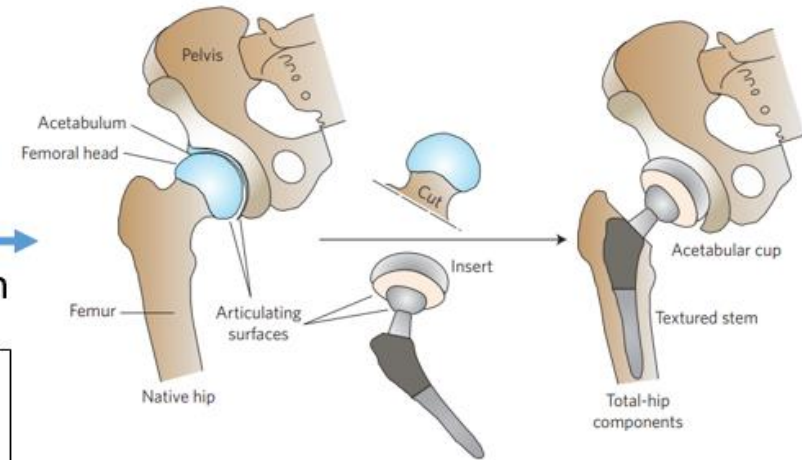
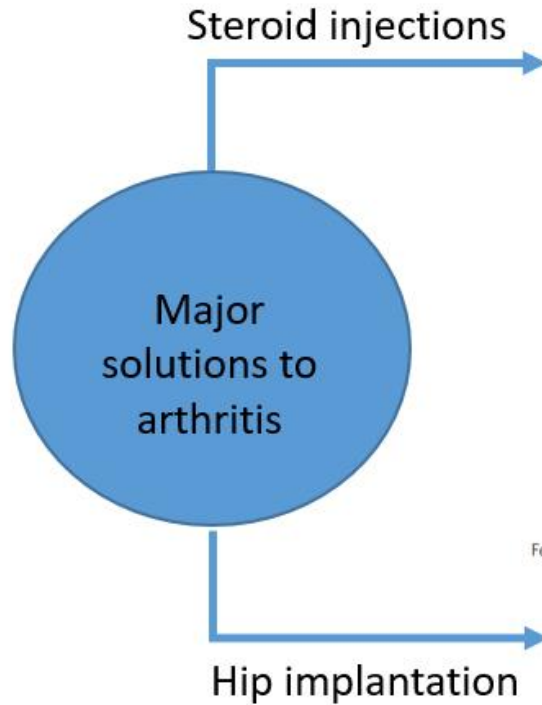


IIT Ropar

Arthritic Hip & its Solutions



- Arthritis, a disease caused by the immune attack on human joints.
- More than 100 types
- Osteoarthritis and rheumatoid arthritis are most common



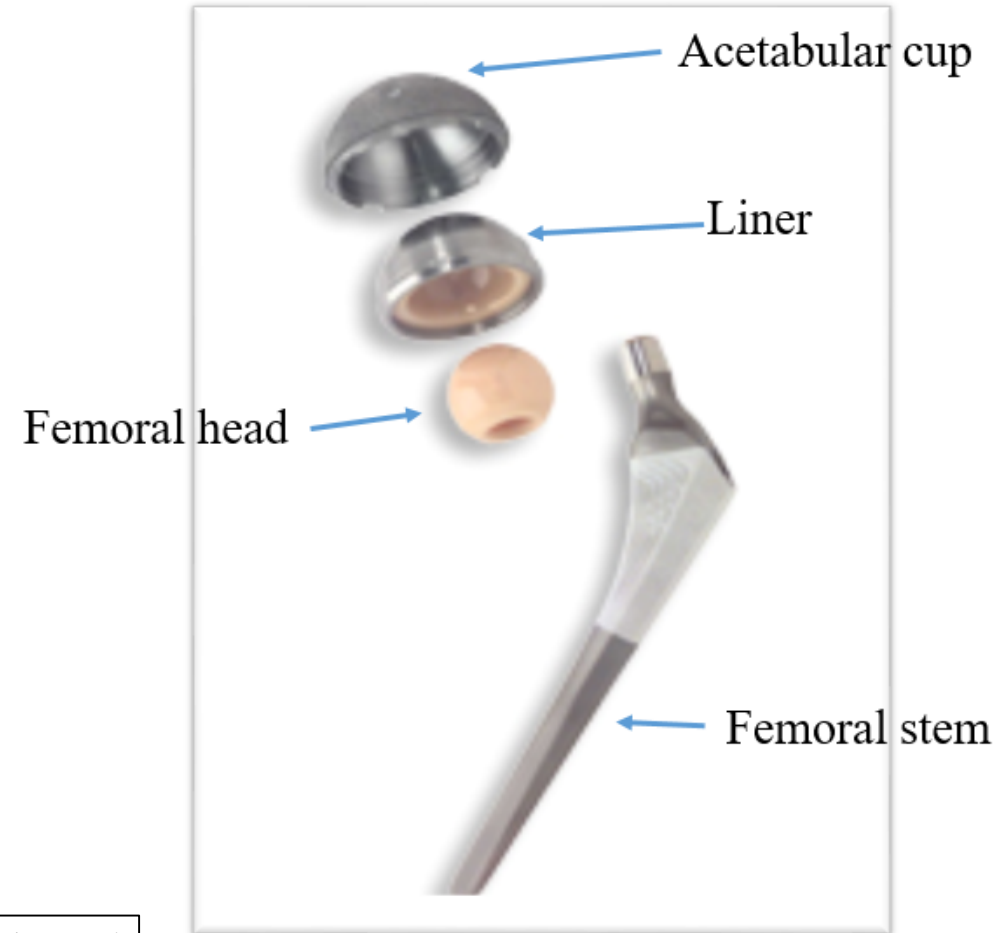
St. Clair Hospital. "Osteoarthritis." Accessed October 12, 2020. <https://www.stclair.org/services/mayo-clinic-health-information/diseases-and-conditions/CON-20164394/>

<https://www.newportortho.com/Orthopedic-Services/Hip.aspx>

E. Ciulli et al., "Tribological Behaviour of Ceramic Hip Replacements," Advances in Science and Technology, 2014

Manufacturing of hip implant

- First generation
 - Manufacturing of base parts (femoral head, femoral stem, liner, and acetabular cup)
 - Base materials: Stainless steel, cobalt chromium alloys, titanium & its alloys, polymers for liner)
- Second generation
 - Surface modification
 - Coating
 - Coating materials: Titanium alloys, hydroxyapatite, alumina etc
 - Coating techniques: Physical vapour deposition, chemical vapour deposition, sol-gel deposition, **thermal spraying** etc



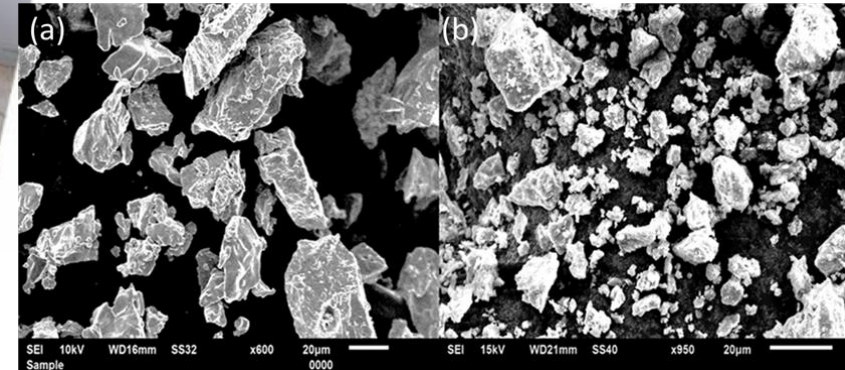
High Pressure Cold Spray System @ IIT Ropar



S.No.	Coating designation	Composition (wt %)	
		Ti	BAG
1	Ti/10BAG	90	10
2	Ti/15BAG	85	15
3	Ti/20BAG	80	20
4	Ti/25BAG	75	25



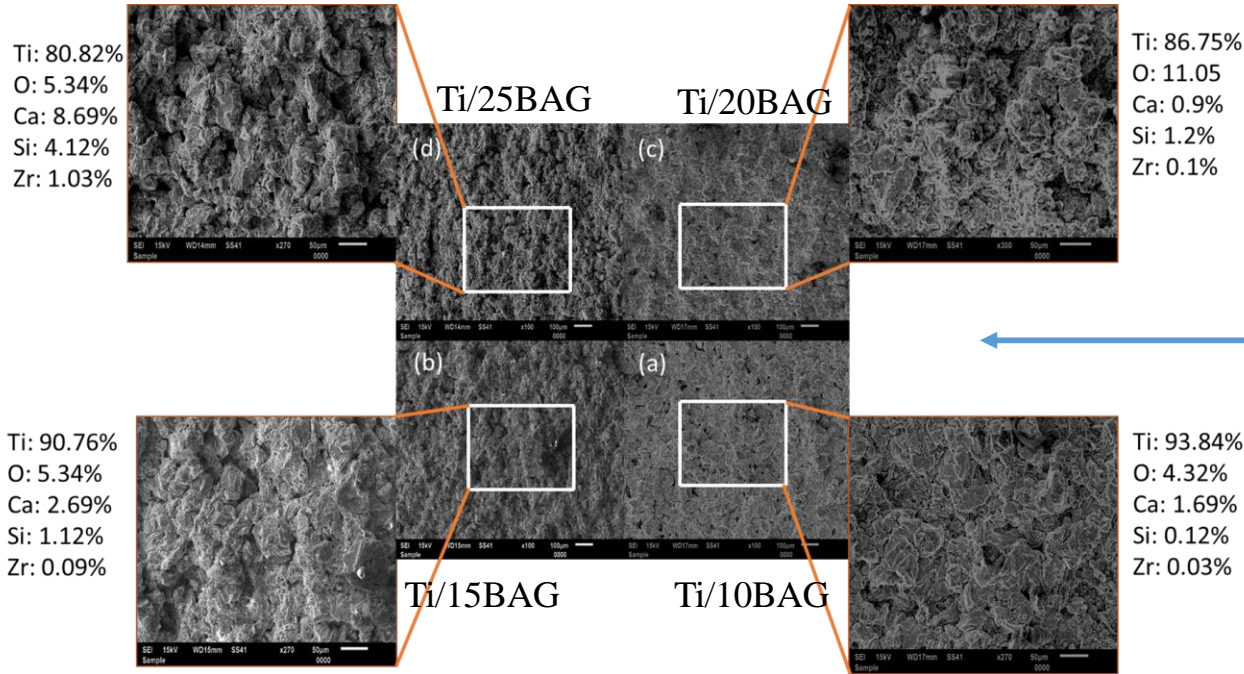
Mixing



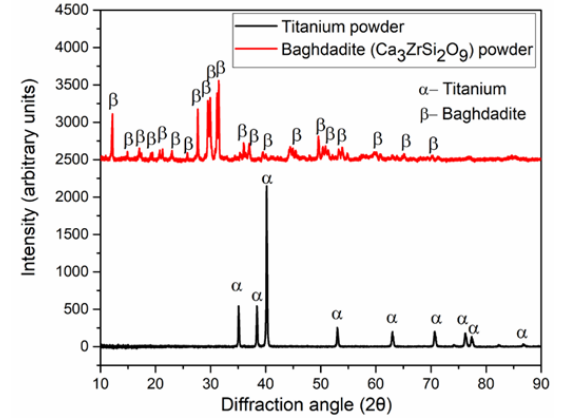
Titanium (Ti)

Baghdadite (BAG)

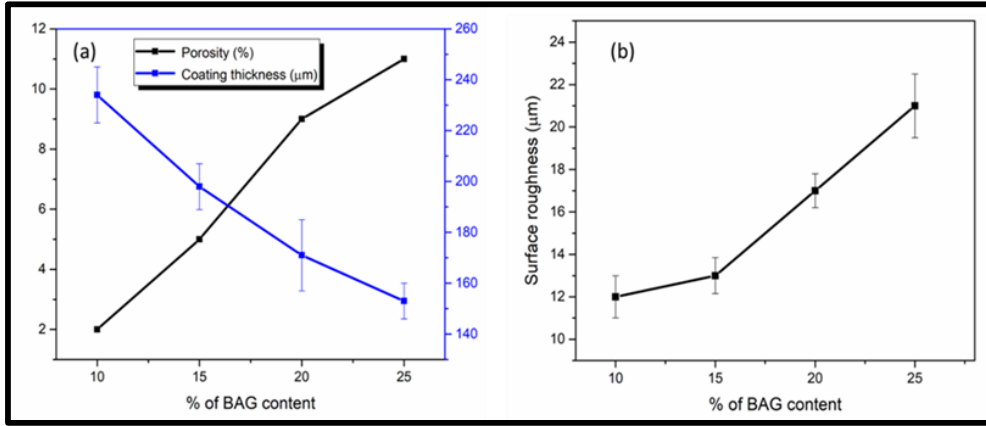
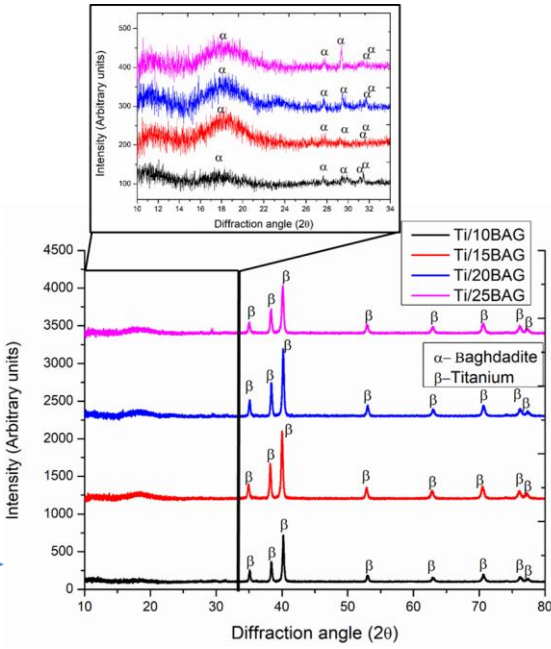
Development and Characterization of Coatings



Surface SEM/EDS analysis

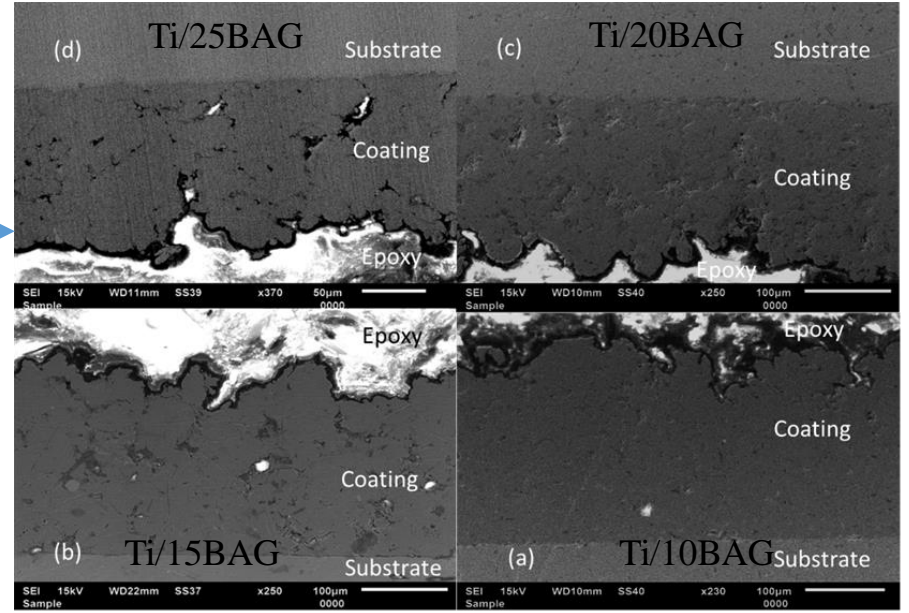


XRD analysis



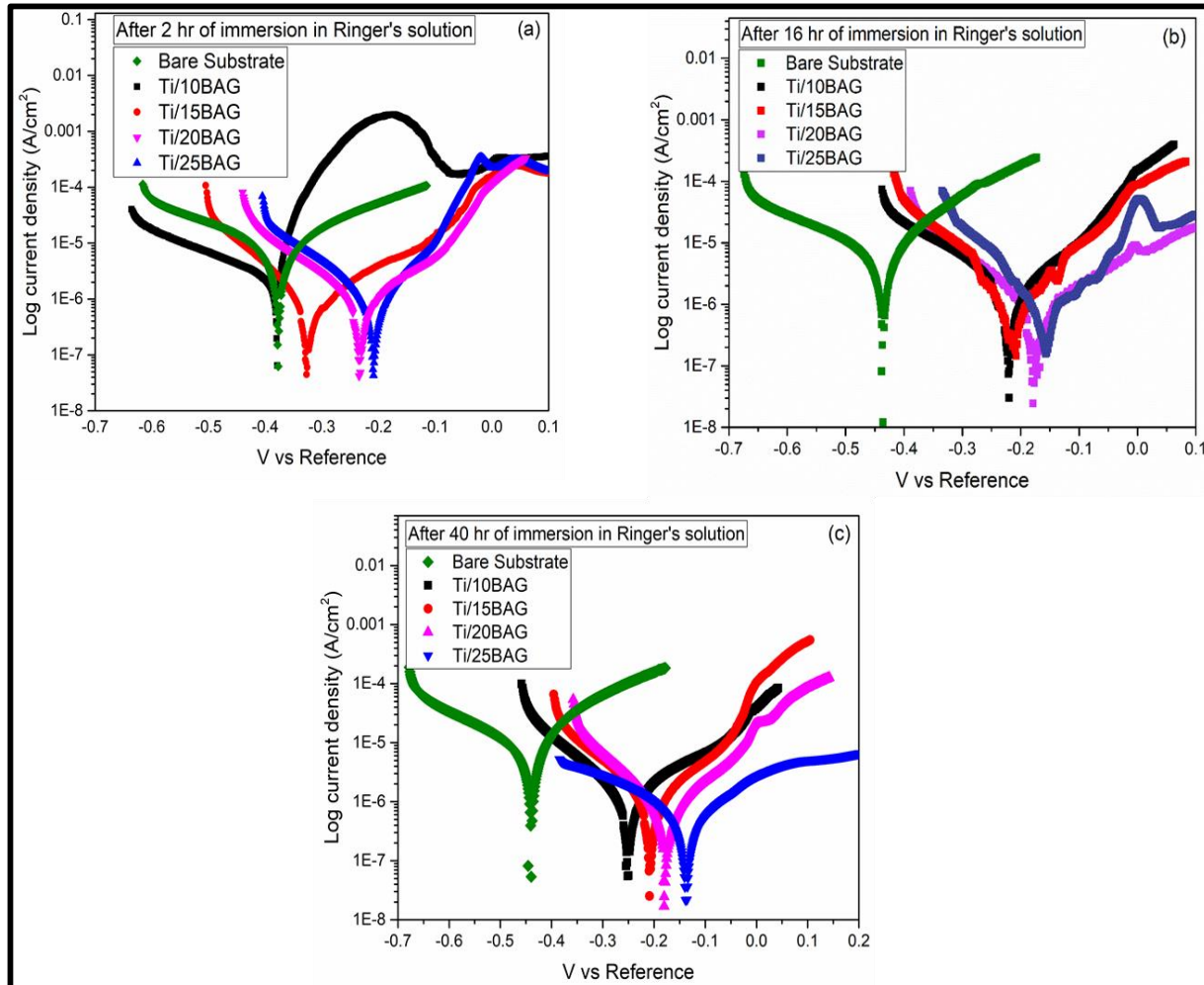
Cross-sectional SEM micrographs of the developed coatings

Effect of BAG on mechanical properties

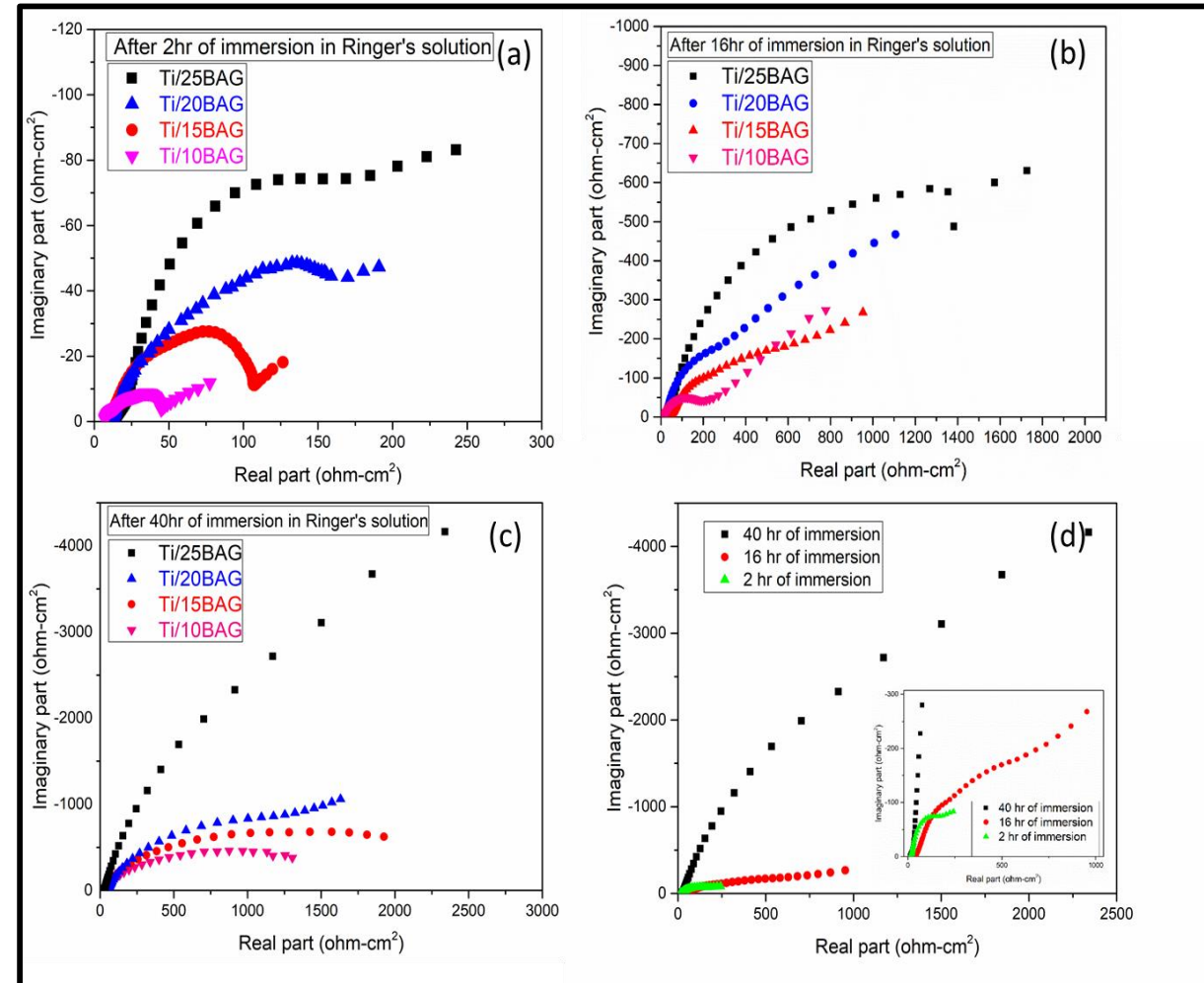


Corrosion Performance of the Developed Coatings

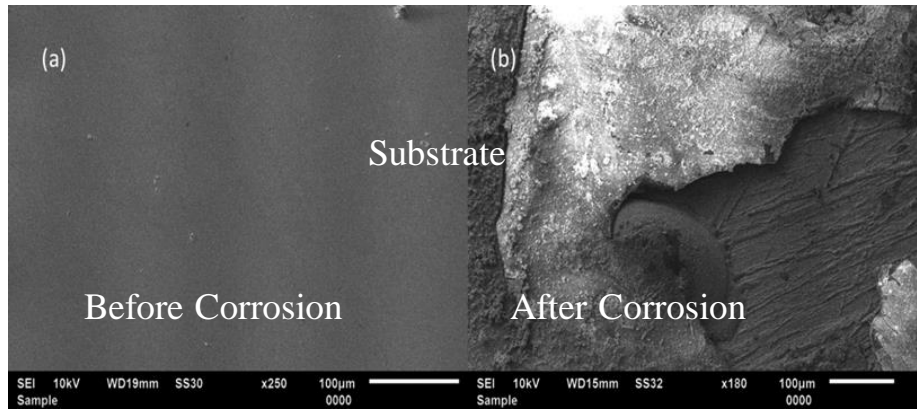
Potentiodynamic scans



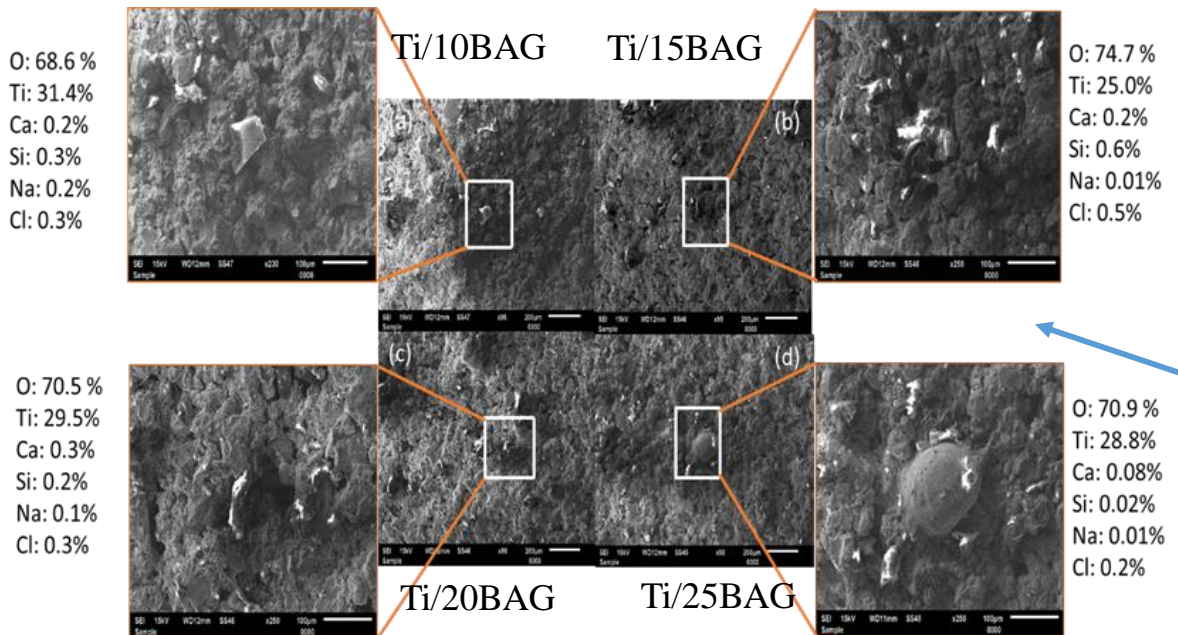
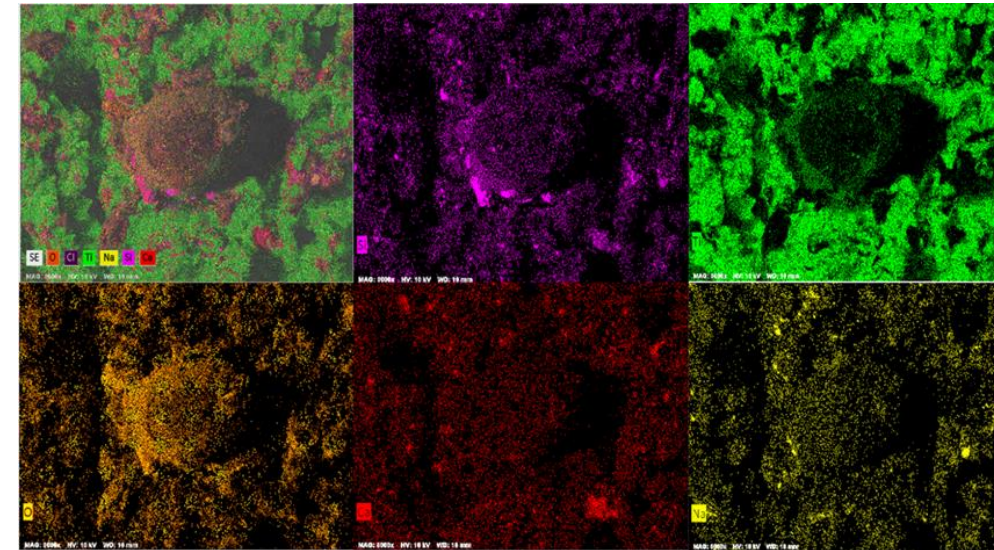
Nyquist plots



Post-Corrosion Analysis

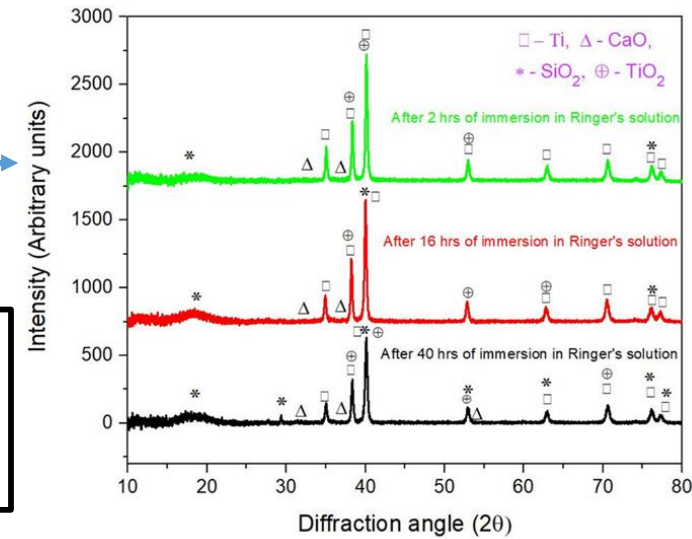


EDS mapping of Ti/25BAG after 2 hrs of immersion in Ringer's solution



XRD analysis of cold sprayed Ti/25BAG coating after 2hrs, 16 hrs, and 40 hrs of immersion time

Surface SEM/EDS analysis of Ti/BAG cold sprayed composite coatings after 2 hrs of immersion in Ringer's solution



- Successful deposition of Ti/BAG composite coating
- Coating protected SS316L substrate from corrosion
- Corrosion resistance of the coating has improved with the increment in BAG content

Thank You