

Targeted Surface Treatment in Safer Solutions for Additively Manufactured Metals

Scientific Achievement

A CINT User Team correlated the role of pulse electrochemical waveform features with surface feature modification in additively manufactured stainless steel, allowing for manufacturing processes in much safer electrolytes and real time.

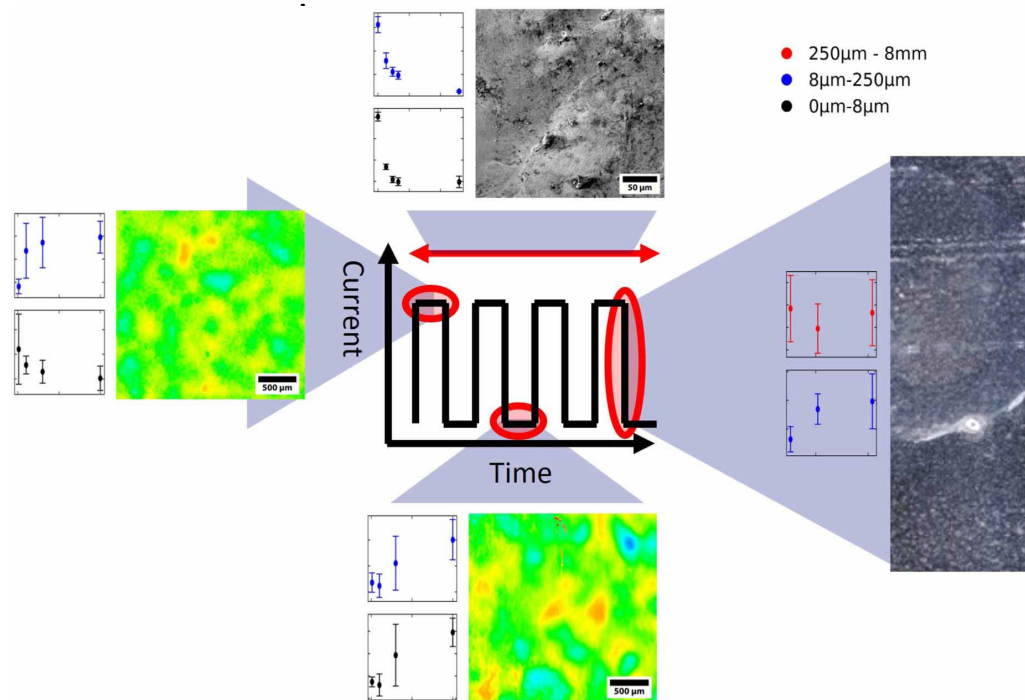


Figure: Pulsed electrochemical processing of additively manufactured stainless steel in dilute acid saltwater (*not traditional concentrated viscous acid*): pulse variables were correlated with specific surface feature modification.

Significance and Impact

Additively manufactured metals are promising but limited by poor surface finish. Traditional methods are hazardous and poorly adapted to these surfaces. Specific waveform variables correlated with scale modifications, allowing real industrial process development to meet surface requirements.

Research Details

- Pulsed electrochemical polishing performed in dilute acid saltwater.
- Pulse waveform variables correlated with roughness scales allowing process design, with roughness reduction of $\sim 10\times$.
- Real-time process monitoring $\rightarrow$ identification of important roughness scale transitions through specific feature changes $\rightarrow$ process design with real-time process control.

Mirabal, A.; Hooks, D.E.; Stull, J. Correlating Pulse Parameters with Roughness Scales During Pulse Electrochemical Polishing of Additively Manufactured 316L Stainless Steel. *J. Electrochem. Soc.* 2026.

Work was performed, in part, at the Center for Integrated Nanotechnologies.