

## **Grain-Based Corrosion Mapping of Commercially Pure Titanium Fabricated via Wire Direct Energy Deposition**

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Wire Direct Energy Deposited (WDED) commercially pure titanium (CP-Ti) shows remarkable potential for producing large structural components. However, the limited understanding of its electrochemical behavior poses a significant barrier to its successful implementation in corrosion-critical applications. The layer-by-layer additive manufacturing process introduces grain size variations, leading to microstructural inhomogeneity due to the complex thermal history. This inhomogeneity may result in diverse corrosion behavior at the microstructural level. Microstructural changes at the layer and interfaces are tracked using a multi-length optical analysis from macro to nanoscale identifying the corrosion mechanisms and critical concentration for the corrosion to initiate. Tests are conducted under progressive 1 to 6 N HCl solution. The critical range for the galvanic corrosion to start is 1 to 2N HCl with high influence of misorientation grain in its propagation. This research provides fundamental understanding of the corrosion resistance of CP-Ti WDED to enable utilization of large structural components.

**Keywords:** WDED, Corrosion; Additive Manufacturing; Microstructure

**Word Count: 149**