Tribocorrosion of Wire Arc Additive Manufactured Commercially Pure Titanium for Marine Applications

Blanca Palacios[1,2], Tanaji Paul[1,2], Tony Tomas[1], Abhijith K. Sukumaran[1,2], Sean Langan[3], Alex Michelson[3], Arvind Agarwal[1,2]

[1]Plasma Forming Laboratory, Department of Mechanical and Materials Engineering, Florida International University, 10555 West Flagler Street, Miami, FL 33174
[2]Cold Spray and Rapid Advanced Deposition Laboratory, Department of Mechanical and Materials Engineering, Florida International University, 10555 West Flagler Street, Miami, FL 33174
[3]Solvus Global LLC, 104 Prescott Street, Worcester, MA, 01605

Wire Arc Additive Manufactured (WAAM-ed) Commercially Pure Titanium (CP Ti) used for producing large marine structural components must survive harsh synergistic effects of wear and corrosion. Therefore, understanding the interaction between these two surfaces phenomena is needed to develop long-lasting moving components. To bridge this gap, this study investigates the tribo-corrosion response of WAAM-ed single-phase α-Ti with respect to directions parallel and perpendicular to the arc motion. The specimen from each direction is subjected to a ball-on-disk tribology test under dry and 0.1N sodium chloride electrolyte concentration mimicking the marine environment. The coefficient of friction, weight loss, and wear rate under the dry and corrosive environment is enumerated. The relationship between wear mechanism as a function of dry and corrosive media is established and correlated to the microstructure. This understanding of the effect of corrosive wear on the performance of WAAM-ed CP Ti significantly contributes to the state-of-the-art development of large-scale additive-manufactured marine structures