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Correlating the microstructure and surface morphology of laser engineered net shape (LENS) 304L series stainless steel to its corrosion response

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In recent years a desire to rapidly prototype complex metallic parts has driven the advancement of metal additive manufacturing (AM). Powder bed selective laser melting (SLM) and laser engineered net shape (LENS) have emerged as prevalent techniques for producing a wide range of complex metal components. That said, the non-equilibrium processes associated these AM techniques lead to microstructural heterogeneity and irregular surface structures throughout components, which can be cause for corrosion behavior considerably different from conventionally processed materials. This presentation will investigate and compare the corrosion behavior of 304L stainless steel produced by the SLM and LENS processes. An emphasis will be on the heterogeneities which lead to the breakdown of passivity for the LENS components when immersed in chloride containing aqueous solutions, utilizing local electrochemical techniques. The impact of surface treatments, such as laser surface modification, have on AM component roughness and subsequently the corrosion response will be explored.