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Nanoindentation and corrosion behaviour of 410 stainless steel fabricated via additive manufacturing

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Abstract

This study investigates the microstructural, nanomechanical, and corrosion behaviour of different sections of 410 steel fabricated via directed energy deposition technique. The morphology exhibited by the longitudinal and transverse sections of the specimens was examined under a scanning electron microscope (SEM), while micro-computed tomography technique (micro-CT) was used for examination of the internal structure of the specimens. Nanomechanical properties were assessed using a nanoindenter, while potentiodynamic polarization technique was adopted to investigate the corrosion resistance of the specimens in a chloride environment. The SEM micrographs revealed minimal pores in the specimens which confirmed the improved density in the layer-by-layer built specimen. Micro-CT images confirmed the presence of tiny pores in the specimens sectioned from the top layer of the 410 stainless steel rod in comparison with the middle- and bottom-sectioned specimens. The corrosion and post-corrosion analyses confirmed that the top specimen exhibits the least corrosion resistance in comparison with the other specimens.