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Macro-defects characterization in cast CA-6NM martensitic stainless steel

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Abstract. Cast low carbon CA-6NM (13%Cr-4%Ni) martensitic stainless steel has been used for hydraulic turbine runners manufacturing since the 60's owing to its high strength, toughness, corrosion, and cavitation-erosion resistance. These castings contain several types of defects which may have detrimental effects on the performance of the produced parts. Several aspects of the casting defects in these steels have not been specifically studied in detail. It is common in industry to evaluate the integrity of cast components by nondestructive testing such as X-ray radiography before putting them in operation. However, tortuous and complex geometry of macro-shrinkage porosities makes them difficult to be characterized precisely only by 2D radiographic results. In the present study, the relation between radiography mapping and actual macro-defect morphologies has been studied by the “salami” cross sectioning method in order to document the real shape and morphology of defects. Furthermore, metallographic characterization of cast microstructure in CA-6NM stainless steels has also been performed using several techniques to document both chemical composition and microstructure around macro-defects. Briefly stated, the main purpose of the investigation described herein is to study several severity levels of macro-defects in cast martensitic stainless steels and investigate some characteristics of real defects which can impact on the fatigue properties of cast parts at microstructural level.

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