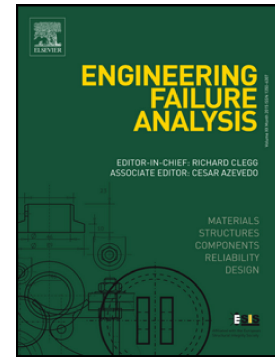


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Failure Analysis of a Failed Anchor Chain Link

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ABSTRACT

The failure of a metal chain link with stud during an anchoring operation of a ship is examined. Visual observation, optical and scanning electron microscopy analyses of the fracture surfaces in combination with hardness and tensile tests are used to establish the cause of failure. The chemical element composition, tensile strength, yield strength and elongation of the base metal of the chain link are within the recommended design values. However, cross-sectional microstructure examination revealed that the fracture occurred along the flash butt weld and initiated from a pre-existing edge radial crack on the outer surface which had been painted over. The presence of inclusions near the outer surface, decarburized boundaries of the inclusions and a decarburized thin strip along the entire weldment had resulted in weldment strength reduction and subsequent initiation of the surface crack. The main cause of the chain link failure is improper flash welding and heat treatment resulting in localised carbide segregations and embrittlement, leading to initiation of surface crack and consequent overload of the remaining net-section area of the chain. There was no evidence of fatigue crack growth. Better inspection and maintenance would have led to early detection of the surface crack during any the periodic non-destructive testing.

Keywords: anchor chain link, failure analysis, weldment, microscopy.

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