عنوان مقاله:

A Detailed Failure Analysis of Vertically Suspended Diffuser Pump Caused by Hex Head Bolt Fracture: The Marine Service Condition

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خلاصه مقاله:

Vertically suspended diffuser pumps play a significant role in the seawater cooling systems of the petrochemical and refinery industries. The present work deals with providing a detailed analysis of mechanisms involved in the early failure of hex head bolt used in the vertically suspended diffuser pump framework, which has served three years in the marine condition. The morphological and microstructural characteristics of the failed bolt were evaluated by optical microscope, scanning electron microscope (SEM), spark-optical emission spectroscopy (spark-OES), and X-ray diffraction (XRD) methods. Besides, microhardness test was performed to assess the mechanical properties of the samples. The results demonstrated the presence of Cr, Fe, Mn, and Si elements in the microstructure of failed bolt, which coincides with the composition of stainless steel (X۵CrMnN۱۷-۸). While there exist sulfur and oxide inclusions in the parts close to the surface, no surface-related defects were detected in the central part. Moreover, the microstructural assay showed that the failed sample was composed of austenite-martensite micro-duplex structure. The microhardness values of regions close to the surface of the failed bolt were higher than that of the central part by ≈۲۰ %, since there is higher martensite content. Fractography images revealed a brittle fracture mechanism in the parts close to the surface, while ductile fracture was observed at the center of the bolt. In general, the main factor governing the failure of the bolt can be attributed to the lack of precise control over the chemical composition of the bolt and the application of inappropriate fabrication process.

کلمات کلیدی:
Failure, Hex head bolt, Vertically suspended diffuser pump, Fractography, Stainless steel