

MEC-E1070 - Selection of Engineering Materials, Lecture, 4.9.2023-13.10.2023

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Started on	Monday, 2 October 2023, 11:41 AM
State	Finished
Completed on	Monday, 2 October 2023, 1:13 PM
Time taken	1 hour 31 mins
Grade	3 out of 3 (100%)

Question 1

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Complete

Name one reason to study failure

Engineering failure is often a rare, localized phenomenon, which is extremely hard to predict in the long run. One reason to study failure is to understand the root causes and mechanisms that led to the failure, allowing for the prevention of similar incidents in the future, thereby ensuring safety and reliability of the materials, components, and systems in operation.

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Question 2

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Complete

Describe how similar failures can happen in different industries.

Similar failures can occur across different industries due to their shared underlying causes or mechanisms. Failures in materials and components often arise from fundamental causes such as material defects, manufacturing errors, operational conditions, or environmental factors. Since many industries utilize similar materials, technologies, and processes, they can be susceptible to the same types of failures. The most notable common forms of failures across many industries are fatigue, creep, brittle fracture, ductile fracture, plastic deformation and environmentally assisted failure such as corrosion.

For example, fatigue is the common failure reason in the aerospace industry [1] and railway industry [2], while corrosion is the common failure reason in gas industry [3] and maritime industry [4].

References:
[1] https://www.researchgate.net/publication/37181698_Fatigue_failure_of_aircraft_components
[2] https://www.researchgate.net/publication/245390338_Railway_axle_failure_investigations_and_fatigue_crack_growth_monitoring_of_an_axle
[3] https://www.dfctank.com/news/corrosion-of-oil-pipelines-and-storage-tanks.html
[4] https://www.corrizonsg.com/marine.html

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Question 3

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Complete

Is there a problem with Nickel alloy 690 under stress?

Nickel alloy 690 is a high-chromium nickel alloy that exhibits excellent resistance to many corrosive aqueous media and high temperature environments. It has good fabrication characteristics, metallurgical stability and high strength [1]. However, when under stress in operating conditions such as as a heat exchanger tube in a steam generator (SG), the Nickel alloy 690 have experienced a variety of corrosion problems such as pitting, intergranular attacks (IGA) and stress corrosion cracking (SCC) [2]. In spite of considerable efforts to reduce the material degradation, SCC remains an important problem to be overcome. These are the common problems that Nickel alloy faces during operation, especially stress corrosion cracking is the most serious potential failure type

References:
[1] https://www.azom.com/article.aspx?ArticleID=9964#:~:text=It%20has%20good%20fabrication%20characteristics,under%20various%20high-temperature%20solutions.
[2] https://www.sciencedirect.com/science/article/pii/S1738573315300085

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