

Corrosion and Wear Analysis in Marine Transport Constructions

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Abstract – Corrosion is one of the most common naturally occurring processes studied by thermodynamics, which includes oxidation process, metal disruption, and its chemical and electrochemical effects under environmental influence. Corrosion of metal and equipment accounts for a considerable proportion of total corrosion losses, thus providing the impetus for further investigation and developments related to corrosion protection in order to provide transport systems and industry with corrosion preventive materials and tools.

Keywords – Corrosion, maritime transport, metal coatings, wear.

I. INTRODUCTION

Protection of metals from corrosion is a topical issue affecting all areas of the world's economy. The losses due to the damage associated with marine transport corrosion during the period of construction or operation constitute approx. 50–80 billion USD and approx. 3 % of world GDP [1]. Statistics show that 90% of ship failures are attributed to corrosion [2].

The effects of corrosion are diverse. First, these are irreversible metal losses (When corrosion is widespread and uniform, with steel in seawater a metal loss of about 0.3 mm per year may be expected [3]). The main losses are related to indirect losses – increase in the mass of metal structures due to corrosion enhancements, increase in the amount of works related to construction manufacturing, reduction of their performance, large volume of repairs, etc.

Experience shows that the proper design of ship structures and use of corrosion protection equipment, qualified operation and timely replacement of damaged structures can reduce the damage caused by corrosion by 33 % of this cost could be prevented by the selection and use of an appropriate corrosion protection system [4]. To reduce the metal capacity of ships by reducing the thickness of structures, increasing the carrying capacity and life of ships.

The diversity of vessel structures and operating conditions create certain difficulties in the design and use of methods and tools for corrosion protection. The most effective way to prevent corrosion is by using various methods of protection.

II. INFLUENCE OF THE MARINE ENVIRONMENT

A ship's hull and structures are exposed to the effects of liquid and gaseous corrosion environment (permanent and periodic) [5], [6].

Sea, river and lake water, atmospheric air as well as various gases represent corrosive environments for vessels and other marine constructions.

Seawater means all ocean waters varying in their salinity and chemical composition. Salinity S – the total amount of minerals, g, per 1 kg of water – is expressed in per mille and is from 2 ‰ to 40 ‰. The average sea and ocean salinity is 35 ‰. The relationship between the concentrations of the main ions of 99.9 % of substance dissolved in the seawater is constant [7], [8]. The exception is closed seas, the Baltic Sea, the Azores Sea, the Caspian Sea, etc., with different ratios. To assess the aggressiveness of environmental corrosion, the ion concentration in the given area is determined by salinity data. For example, in the Baltic Sea the salinity of water in the upper layers ranges from

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Table of Contents Systems Analysis In Marine Transport Projects Problems

1. Understanding the eBook Systems Analysis In Marine Transport Projects Problems
 - The Rise of Digital Reading Systems Analysis In Marine Transport Projects Problems
 - Advantages of eBooks Over Traditional Books
2. Identifying Systems Analysis In Marine Transport Projects Problems
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Systems Analysis In Marine Transport Projects Problems
 - User-Friendly Interface
4. Exploring eBook Recommendations from Systems Analysis In Marine Transport Projects Problems

- Personalized Recommendations
- Systems Analysis In Marine Transport Projects Problems User Reviews and Ratings
- Systems Analysis In Marine Transport Projects Problems and Bestseller Lists
- 5. Accessing Systems Analysis In Marine Transport Projects Problems Free and Paid eBooks
 - Systems Analysis In Marine Transport Projects Problems Public Domain eBooks
 - Systems Analysis In Marine Transport Projects Problems eBook Subscription Services
 - Systems Analysis In Marine Transport Projects Problems Budget-Friendly Options
- 6. Navigating Systems Analysis In Marine Transport Projects Problems eBook Formats
 - ePub, PDF, MOBI, and More
 - Systems Analysis In Marine Transport Projects Problems Compatibility with Devices
 - Systems Analysis In Marine Transport Projects Problems Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Systems Analysis In Marine Transport Projects Problems
 - Highlighting and Note-Taking Systems Analysis In Marine Transport Projects Problems
 - Interactive Elements Systems Analysis In Marine Transport Projects Problems
- 8. Staying Engaged with Systems Analysis In Marine Transport Projects Problems
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Systems Analysis In Marine Transport Projects Problems
- 9. Balancing eBooks and Physical Books Systems Analysis In Marine Transport Projects Problems
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Systems Analysis In Marine Transport Projects Problems
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Systems Analysis In Marine Transport Projects Problems
 - Setting Reading Goals Systems Analysis In Marine Transport Projects Problems
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Systems Analysis In Marine Transport Projects Problems

- Fact-Checking eBook Content of Systems Analysis In Marine Transport Projects Problems
- Distinguishing Credible Sources

13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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