International Journal of Social Science Research and Review

http://ijssrr.com
editor@ijssrr.com
Volume 6, Issue 1
January, 2023
Pages: 186-192

Ferrocement for Maritime Security and Safety Platforms

Hazen Alrasyid; Fiorentina Nulhakim; Virgin Kristina Ayu; Jupriyanto

Defense Industry Study Program, Faculty of Defense Technology, Defense University of the Republic of Indonesia, Indonesia

E-mail: hazen.alrasyid@tp.idu.ac.id

http://dx.doi.org/10.47814/ijssrr.v6i1.769

Abstract

Indonesia's abundant natural resources will provide benefits in supporting the welfare of the nation, but can also become an opportunity for threats to the security and safety of the nation. This source of wealth can be exploited by one of them studying how ferrocement materials are suitable for use as materials to create a platform for national security and safety. The purpose of this study is to find out the application of Ferrocement Materials in its application for maritime security and safety. The results of the study show that ferrocement materials can be used as an alternative for the needs of designing maritime safety and security platforms. Based on the nature of the ferrocement, it can be used for any floating platform that is not moving. Even if it moves as long as it doesn't rely on speed. The strong reason that this ferrocement material was chosen was because the ferrocement components could be produced in Indonesia. This is because Indonesia has abundant natural resources. The Ferrocement Material has been widely used for the design of maritime security and safety platforms. An example is the construction of the base ship hull, the red and white ships I and II and the Ferrocement Autonomous Buoy System (Fecabs).

Keywords: *Ferrocement Materials; Maritime Security; Maritime Safety*

Introduction

Indonesia is an archipelagic country with a wealth of natural resources, which can provide benefits in supporting the welfare of the nation, but can also become an opportunity for threats to the security and safety of the nation (Setiadji, 2021). Indonesia as a large maritime country, the biggest threat comes in the territorial waters as well. This is an urgency for the need to develop a good military defense posture by looking at the resources owned by Indonesia. As for the development of a military defense posture, the goal is to fulfill the Minimum Essential Force. Namely by fulfilling the main components and preparing other defense components, with development priority for maritime defense forces. Effectively maintaining maritime security is of course directed to be able to monitor the security of the Pacific and

Indian Ocean regions. So that the map of the elemental strength of the sea is built to be able to reach the outermost and foremost small islands. The development and acceleration of mastery of defense industry power technology is carried out based on the mandate of Law Number 16 of 2012 concerning the Defense Industry, wherein the a quo Law requires Defense Industry production actors to choose materials for Indonesian-made defense and security production and requires users to prioritize the use of local defense and security in terms of achieving the power of the defense industry.

By definition, materials are used as raw materials in a production process in the industry. While the material industry itself produces materials that are ready to be used in meeting the needs of the design and engineering industry. An example of its application is iron ore as a raw material for the material industry that produces steel for design and engineering. In self-sufficiency in defense equipment, the material industry needs to be supported as a national agenda because it can become a production force for the national defense industry and also reduce dependence on imported materials. In the integrated and systematic planning that has been made for processes in the material industry, Indonesia has abundant resources and can be said to be able to use its own raw materials. The availability of the Indonesian material industry has only reached 45% for defense equipment readiness. So that this problem can be overcome by efforts to increase the use and utilization of the country's natural resources for the development of defense equipment.

The material that is considered to be utilized and has superior value in the manufacture of defense and security is one of them is ferrocement, which can be categorized as a composite material because it is composed of reinforcement and matrix. Ferrocement can be applied to the construction of Ships, Silos, Roofs, Tanks, Reinforcement and Repair of Reinforced Concrete Tanks, Beams, Plates, Columns (Shaheen, YB, Soliman, NM, & Kandil, DEM 2013). Indonesia as an archipelagic country consisting of waters as stated in Law Number 17 of 1985 concerning Ratification of the Archipelagic State (Archipelago State) needs to emphasize the development of maritime-based forces and defense. In the ship construction process as one of Indonesia's assets as a maritime country, the materials used must have reliable specifications.

Research Method

The research method used in this research is qualitative research. The type of research in this study is a library research. Sugiyono (2012) states that library research is a study of theories, references and other scientific literature related to culture, values and norms that develop in the social situations studied. While the data used for this study, data obtained from observation of books, scientific journals, and electronic media that discuss Ferrocement materials. This is in accordance with the opinion of Nazir (2003) which states that data collection is carried out by conducting a review of books, literature, notes, and various reports relating to the problem to be solved.

Result and Discussion

Results

A. Materials Industry

The Materials Industry is an industry that aims to meet the needs of the design and engineering industry in producing engineering materials which are grouped into 6 groups, namely metals, rubber polymers, glass, ceramics and hybrids. Metals are materials with a structure consisting of cysts with a size of 10-1 – 10-4 cm, for example titanium, cast iron, alloy metals, steel. The polymer group consists of polyethylene, polycarbonate, polypropylene. Rubber is a material with a composition of materials that has

the ability to deform quickly or be able to return to its original shape, for example isoprene, neoprene, natural rubber, which is included in the rubber group. Glass is a material with an arrangement of ions that form a network, for example borosilicate glass, soda, silicate. Ceramics group consisting of silicon nitride, silicon carbide, alumina, and others are materials with basic ingredients of a mixture of inorganic materials, while the hybrid or composite group, are materials with basic ingredients consisting of a combination of several varying compositions. (Sahlan, 2018)

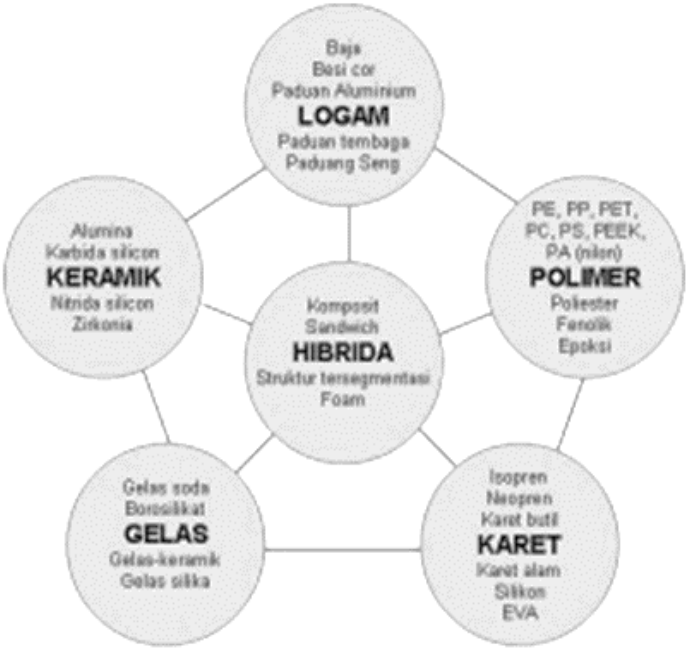

Figure 1. Classification of Engineering Materials

Source:Shalan, 2018

B. Ferrocement Materials

Ferrocement is a material made of hydraulic cement mortar with wire reinforcement which can be categorized as a type of thin-sized reinforced concrete with layer spacing and wire mesh sizes made of metallic or the like with tight layer spacing (Wire Mesh; Naaman, 2000: 9 quoted from ACI Committee 549, 1980). Ferrocement with a constituent material consisting of a mixture of cement, water, and other addictive materials as a matrix is a reinforcing aggregate which is categorized as a particle composite, with the addition of wire bones in this material, thus categorizing ferrocement as a Fiber Composite. While it is said to be a layered composite category because Ferrocement consists of wire bones that can be formed into layers.[1]

[1]http://elearning.litbang.pu.go.id/technology/beton-ferosemen

Table 1. Composition of the Ferrocement Experiment (Shaheen et al. (2020))

No.	Ingredient	Size
1	Cement and Aggregate	(1:2)
2	Water	(35%)
3	Plasticizers	(2%)
4	Silica Powder	(10%)
5	Polypropylene	(90 g/m3)
6	Bone Wire (Wire Mesh)	
7	Steel Bars	
8	StyroFoam	(2cm thick)

Meanwhile Zhai et al. (2021) conducted experiments with slightly different compositions, as shown in table 2.

Table 2. Composition of the Ferrocement Experiment (Zhai et al. (2021))

No.	Ingredient	Size
1	Cement	(700 kg/m3)
2	Silica Powder	(140 kg/m3)
3	Diluent	(110 kg/m3)
4	Kali Sand	(10%)
5	Water	(152 kg/m3)
6	Plasticizers	(22.8 kg/m3)
7	Steel Fiber	(156 kg/m3)

Apart from Composition, both Shaheen and Zhai carry out different processes in their preparation. Shaheen does the complete preparation while Zhai doesn't do the lamination process. However, based on the composition of the materials used, both can be declared identical.

C. Maritime Security and Safety

As a maritime country, maritime security and safety is one of the top priorities, benchmarks and basis for the continuity of the state in decision makers. According to Law number 17 of 2008, article 1 point 32 states that shipping safety and security which includes transportation in waters, to ports and the maritime environment is a condition of fulfilling safety and security requirements. In the process of shipping, the security and safety of ships sailing from the time they depart to their destination are safe and secure.

The maritime strategy is closely related to maritime security which is strengthened by the Indonesian Navy. Maritime security is an effort made to provide a safe situation by mitigating risks and preventing maritime threats that are not based on legal regulations. Maritime security has measurable combinative preventive and responsive measures to deal with various future maritime threats such as territorial violations, threats of maritime terrorism, illicit trafficking in weapons of mass destruction and related materials, sea robbery and piracy, to separatist movements that can disrupt sea traffic. With the increasing use of technology and the development of the current modus operandi, it can be measured that various kinds of threats will continue to increase.

The government as a regulator and law enforcer has obligations in administering government in various fields, especially in the sea as a maritime nation. Efforts need to be made to maintain and create optimum safety in shipping, utilization of waters to efforts to uphold and protect against threats of violations. Maritime security and safety is a condition of the maritime environment that is free from various disturbances and threats to territorial sovereignty and national interests. There are these threats. As a maritime country, maritime security is very influential on the continuity of security in the land area so that it is necessary to strengthen security which is supported by the contribution of various components, especially law enforcement institutions. one of which is the support of qualified marine infrastructure, namely ships as a fleet used for patrolling, surveying and guarding the territory of Indonesia. (Prasetyo, KA, Prakoso, LY, & Sianturi, D. 2021).

Discussion

D. Ferrocement Applications for Maritime Security and Safety

Ferrocement material has characteristics that are easy in terms of repair and resistance to fire so that taking these characteristics into account makes it possible for this material to be an alternative material for ship building. According to Whang, 1972 Ferrocement material is also superior in terms of construction costs because material costs and labor costs are cheaper compared to other materials. The material costs incurred for ferrocement raw materials are more affordable because the raw materials are widely available. Shaheen et al. (2020) conducted a Pressure Test on Ferrocement which was made in layers (laminate) measuring 50 cm x 50 cm with a composition of two layers of Ferrocement each 1.5 cm thick flanking a 2 cm thick Styrofoam layer so that the total layer thickness was 5 cm.

Research conducted by Rismawan (2014) regarding the flexural strength of ferrocement materials shows that this material is able to float on its own and bear heavy loads because it has sufficient buoyancy. The ferrocement used for this pontoon can be used to make various multi-purpose floating devices. One application that can be used is for the manufacture of ships that require buoyancy as the security and safety of the ship.

In Indonesia the development of Ferrocement materials is carried out in Sukajadi Village, Carita District, Pandeglang, Banten as a material for shipbuilding. PT Carita Boat Indonesia has built two ships from Ferrocement material for ship hulls, namely the Merah Putih I Ship and the Merah Putih II Ship ordered by Kodim 0601/Pandeglang (Maritimnews, 2022). The development of the Ship Hull Industry using ferrocement and reducing the material composition of steel plates was carried out together with research from the Indonesian Defense University to reduce costs incurred and speed up the implementation of ship production (Sudiro, 2022).

With the strength and specifications possessed by this ferrocement material, this material was later developed for many ship frames, especially in the hull because it provides stability in the operation of the ship. As in the German Ferrocement Ship, namely the M/V Capella with a length of 40.5 m and a weight of 337 Tons which has been in operation for 45 years, it has stability when it collides with blocks

of ice in winter in its operating area, the Baltic Sea (Dolny, 2018). Ships that are in proper condition will provide security in crossing people and goods, but on the other hand ships whose conditions are doubtful will cause obstacles during the voyage.

Indonesia, with geographical conditions as an archipelagic country, is currently designing a Ferrocement Autonomous Buoy System to be used as a means of maritime defense and security systems in Indonesia. Fecabs consists of ferrocement components and various systems and can float in the middle of the sea because it has proportional stability. The hull uses ferrocement components which are equipped with radar, sonar and Automatic Identification System (AIS). Fecabs are also used to increase maritime security stability with the Static Unmanned Maritime Border Patrol as an action to fill gaps in guarding broad waters such as terrorism, entry of foreign ships, drug smuggling and others. In defense terms there is a strategy of Ways, Means, and Ends where in carrying out their duties in guarding the waters the strategy for protecting the waters is so that the sea can be monitored for 24 hours because it is impossible to do this by sawing such a large sea. With these fecabs half of the patrol function can be carried out so that the function of controlling the sea area can be more efficient without the need to leave the position (Maritimnews, 2021).

Conclusion

Ferrocement material can be used as an alternative for the needs of designing maritime security and safety platforms. Based on the nature of the ferrocement, it can be used for any floating platform that is not moving. Even if it moves as long as it doesn't rely on speed. The strong reason for considering this metal ferrocement was chosen was because the ferrocement components could be produced domestically. This is because Indonesia has abundant natural resources. The Ferrocement Material has been widely used for the design of maritime security and safety platforms. An example is the construction of the base ship hull, the red and white ships I and II and the Ferrocement Autonomous Buoy System (Fecabs).

Ferrocement materials can be applied to various platforms, especially in the field of defense and security. For this reason, the suggestion for further research is to conduct research related to the ferrocement ship to be used as a target ship (shooting target) for practice because the cost of manufacture is cheap and if it sinks it will become a natural coral reef.

References

Article. (2022). Fecabs an efficient maritime security support tool. http://maritimnews.com/2022/01/fecabs-alat-penjuang-keamanan-maritim-yang-efficient/amp/. Retrieved August 14, 2022.

Hetharia, W. (2021). Problems and Solutions Around the Maritime Industry in Indonesian Waters. Pattimura University.

Kadarisman, M. (2017). Maritime safety and security policies in supporting the sea transportation system. Journal of Transportation & Logistics Management, 4(2), 177-192.

Kristanto, A (2010). Diktat Lectures Materials Engineering. Yogyakarta.

Prasetyo, KA, Prakoso, LY, & Sianturi, D. (2021). The Indonesian Government's Marine Defense Strategy in Maintaining Maritime Security. Naval Defense Strategy, 5(1).

Rismawan, R., & Adietya, BA (2014). Flexural Strength Analysis of Woven Wire Reinforced Ferrocement Materials as Basic Materials for Modular Floating Pontoons. Journal of Marine Engineering, 2(4).

Sahlan. 2018. Studies Related to the Defense and Disaster Materials Industry from the Market Side. Journal of Power Plants. 6(1). 26-31.

Setiadji, A. (2021). Direction of Defense Independence. Indonesian Defense University. Jakarta.

Shaheen, Yousry B. et al. 2020. Developing of Light Weight Ferrocement Composite Plates. AICSGE-10 Structural Engineering Department, Faculty of Engineering, Alexandria University, Alexandria 21544, Egypt.

Soewarso, 1981. Archipelagic Insight. National defence. National Security. Published in order to participate in disseminating the Basic Doctrine of Archipelagic Insight and National Resilience.

Sudiro, PAS (2022). The Multihelix Concept of the Independence of Bakamla RI in the Procurement of Patrol Boats. Journal of Defendonesia. 6(1). 37-47.

Sugiono. 2018. Qualitative Research Methods. Alphabet Publishers. Bandung.

Whang, B. 1972. Comparison Study of Aluminum, Ferrocement, and Fiber-Reinforced Plastic for Small Craft in Korea. Naval Ship Research and Development Center. Bethesda. Maryland 20034., https://silo.tips/download/nl-iresearch-and-development-center.

Zhai, YX et al. (2021). Impact resistance of armor steel/ceramic/UHPC layered composite targets against 30CrMnSiNi2A steel projectiles. International Journal of Impact Engineering 154.

Copyrights